

UNCLASSIFIED

per Washington AG Publications Depot
Info Bull. no. 38, 20 Sept 54 Sec IV

RESTRICTED
Security Information

FM 101-10

DEPARTMENT OF THE ARMY FIELD MANUAL

STAFF OFFICERS' FIELD MANUAL

ORGANIZATION TECHNICAL, AND LOGISTICAL DATA

RETURN TO ARMY LIBRARY
ROOM 1 A 518 PENTAGON

RETURN TO ARMY LIBRARY
ROOM 1 A 518 PENTAGON



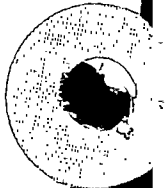
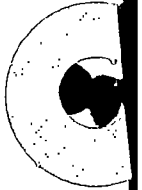
~~FOR OFFICIAL USE ONLY~~
~~Security Information~~

DEPARTMENT OF THE ARMY

JULY 1953

~~RESTRICTED~~

PROPERTY OF U. S.



FOREWORD

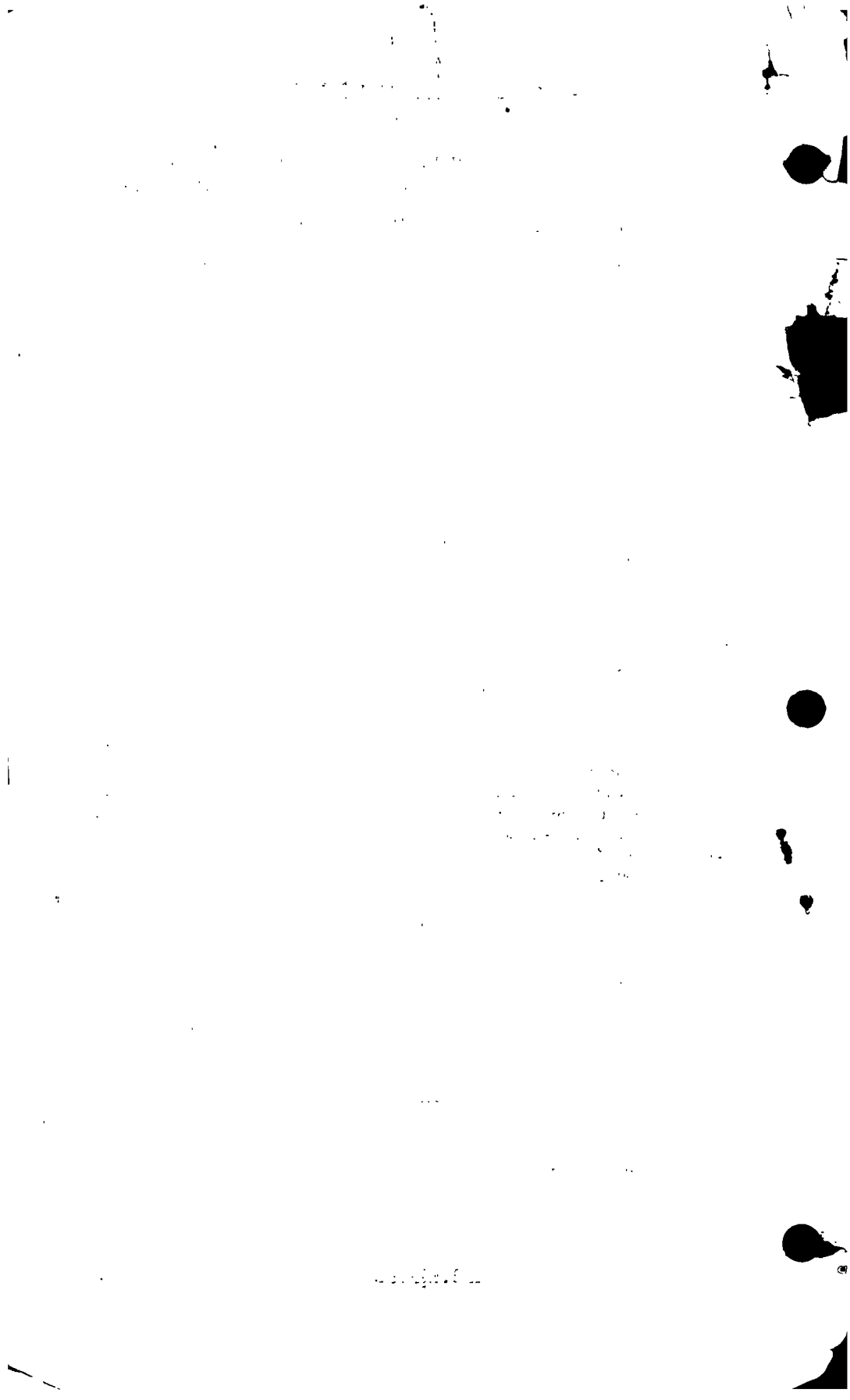
This manual is for use as a planning guide only. It provides general planning data for general staff officers of all echelons. Detailed reference data are found in tables of organization and equipment, field manuals, technical manuals, technical bulletins, and supply bulletins as outlined in SR 310-20 series. The principles and procedures of administration are contained in FM 100-10; the duties of staff officers and the principles and procedures of staff action are contained in FM 101-5.

Where tons are shown, the short ton (2,000 lb) is intended unless the long ton (2,240 lb) or the measurement ton (40 cu. ft.) is specified.

Caution: Data contained herein are based on experience principally from World War II, and can be applied to the future only with judgment and discrimination. Wherever a known factor is available, it should be used instead of one from this manual.

Tables and examples in chapters 1 through 9 are not, in all cases, based on latest tables of organization and equipment, and computations must be adjusted accordingly.

FOR OFFICIAL USE ONLY
(Sec II, DACir 107, 1954)



FIELD MANUAL
No. 101-10

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., 8 July 1953

STAFF OFFICERS' FIELD MANUAL **ORGANIZATION, TECHNICAL, AND** **LOGISTICAL DATA**

	<i>Paragraph</i>	<i>Page</i>
CHAPTER 1. ORGANIZATION		
Section I. General.....	1, 2	3, 4
II. Army, corps, task force, and logistical command.....	3-6	6
III. Airborne division.....	7-9	10
IV. Armored division.....	10-12	10
V. Infantry division.....	13-15	10
VI. Amphibious support brigade.....	16-18	11
CHAPTER 2. PERSONNEL		
Section I. General.....	19	16
II. Losses and replacements.....	20-23	16
III. Prisoner of war capture rates.....	24-27	40
IV. Personnel services.....	28-30	42
V. Internal arrangement of headquarters.....	31-34	43
CHAPTER 3. INTELLIGENCE		
Section I. General.....	35	49
II. Maps.....	36-43	50
III. Time, tide, and light.....	44-46	74
CHAPTER 4. OPERATIONS		
Section I. Troop planning.....	47-53	80
II. Tactical troop movements.....	54-57	107
III. Training.....	58-61	153
IV. Tactical operations.....	62-63	156
V. Signal communication.....	64-71	174
VI. Field engineering.....	72-79	180
CHAPTER 5. LOGISTICS—SUPPLY		
Section I. General.....	80, 81	196
II. Class I supply.....	82, 83	198
III. Classes II and IV supply—dimensions and weights.....	84-91	199
IV. Class III supply.....	92-102	210
V. Class V supply.....	103-118	231
VI. Miscellaneous supply.....	119-122	278
VII. Requirements.....	123-144	283
VIII. Procurement.....	145	307
IX. Storage.....	146-156	307
X. Distribution.....	157-160	321
CHAPTER 6. LOGISTICS—EVACUATION AND HOSPITALIZATION		
Section I. Estimate of patients.....	161-165	329
II. Bed requirements.....	166-169	333
III. Transportation of casualties.....	170-172	339
IV. Animals.....	173-179	340

*This manual supersedes FM 101-10, 15 August 1949, including C 1, March 1950.

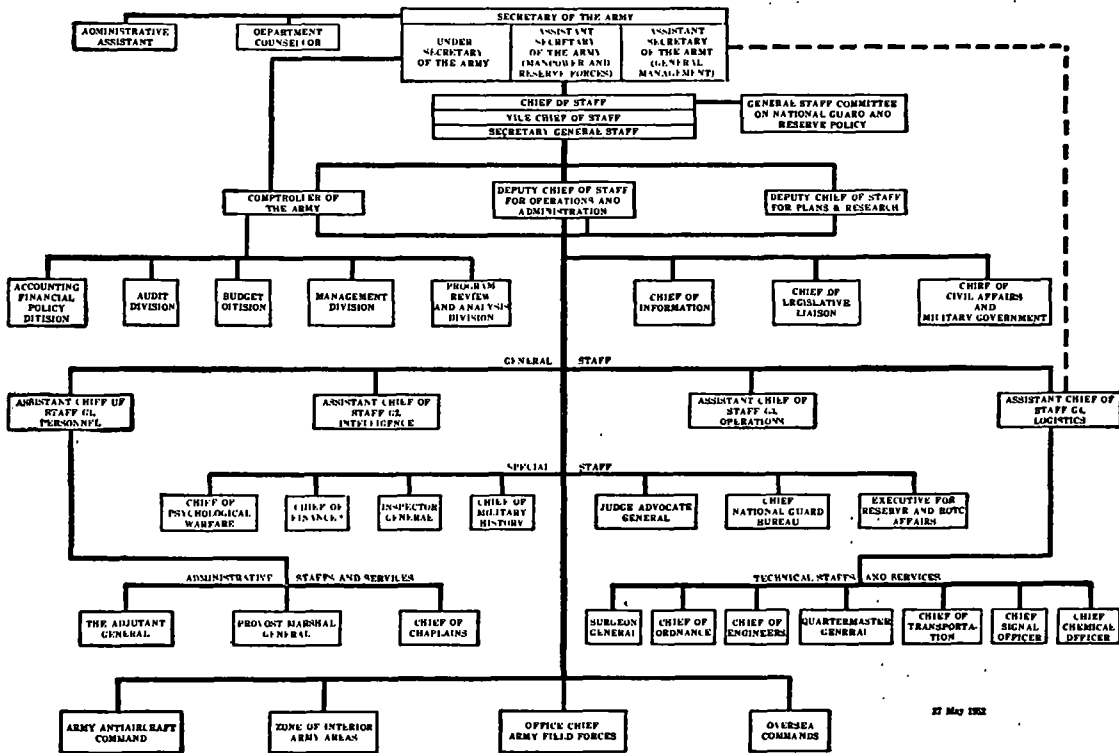
RESTRICTED—Security Information

	<i>Paragraph</i>	<i>Page</i>
CHAPTER 7. LOGISTICS—TRANSPORTATION		
Section I. General.....	180-183	343
II. Pipelines.....	184, 185	347
III. Inland waterways.....	186-188	347
IV. Railways.....	189-199	350
V. Movement of troop units by rail.....	200-212	357
VI. Highway transport.....	213-221	368
VII. Helicopters.....	222-224	373
VIII. Miscellaneous transport modes.....	225-229	375
IX. Terminals.....	230-234	378
X. Transport aircraft.....	235-239	396
XI. Ocean shipping.....	240-249	413
CHAPTER 8. LOGISTICS—SERVICE		
Section I. General.....	250-253	429
II. Engineer.....	254-261	432
III. Ordnance.....	262	470
IV. Signal.....	263	471
CHAPTER 9. LOGISTICS—MANAGEMENT		
Section I. General.....	264, 265	476
II. Logistical factors.....	266-269	477
CHAPTER 10. MISCELLANEOUS		
Section I. Conversion factors.....	270-277	480
II. Physical constants.....	278-283	484
APPENDIX. REFERENCES		485
INDEX		487

CHAPTER 1 ORGANIZATION

Section I. GENERAL

1. Department of the Army—Organization

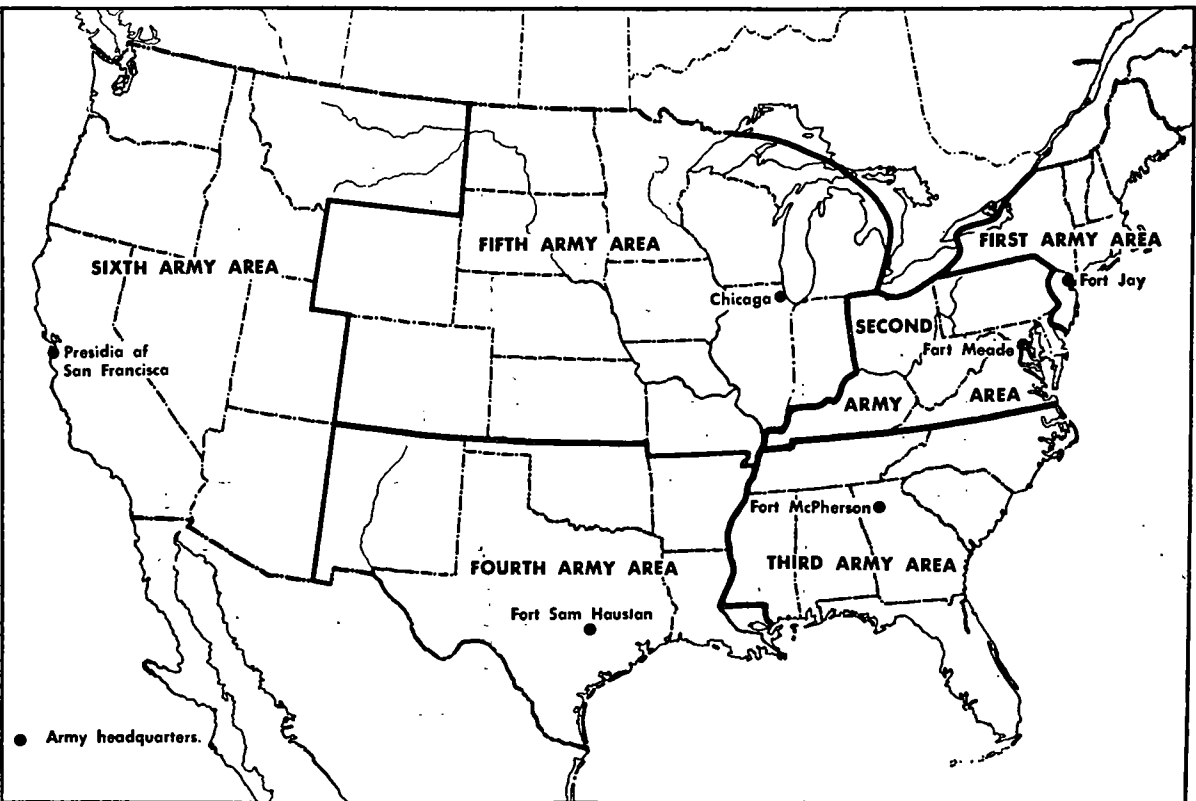


* Under direct supervision and control of the Comptroller of the Army on Comptroller statutory functions.

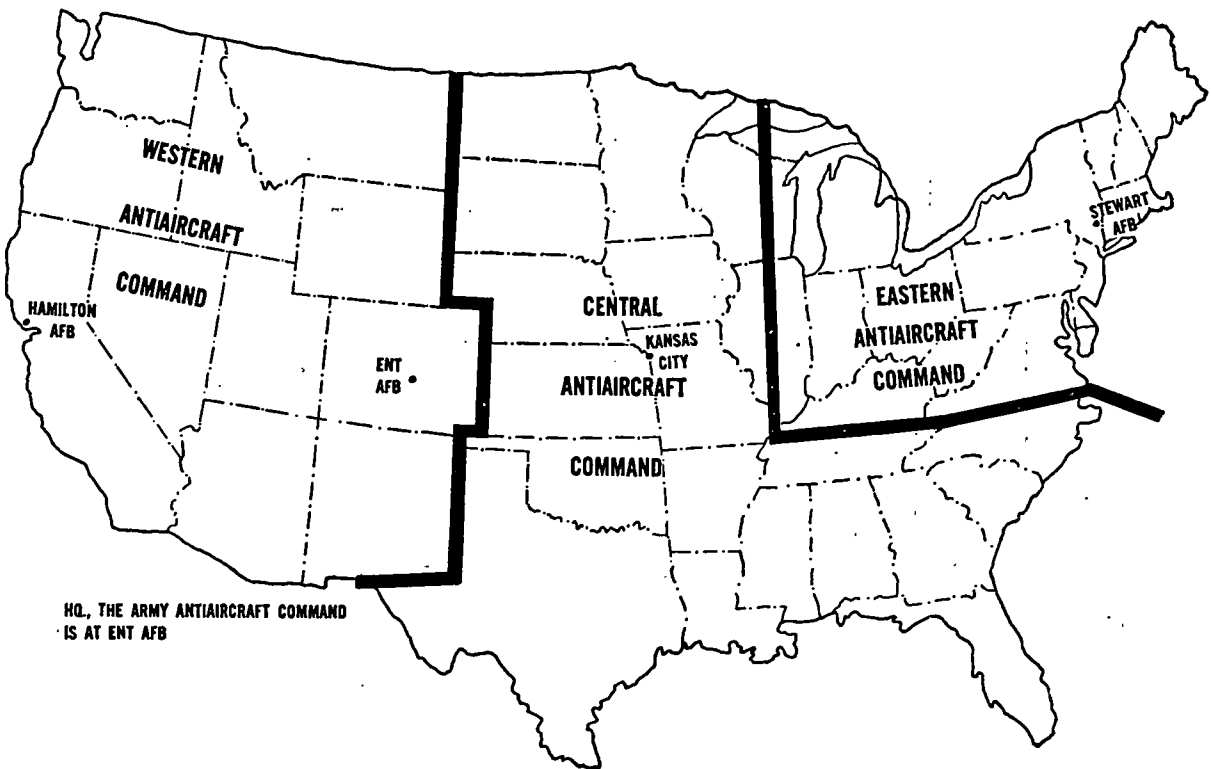
--- Supervision over procurement, research and development, and industrial matters (See AR 54)

27 May 1952

RESTRICTED

2. Army Areas and Army Antiaircraft Command*a. Army Areas.*

b. Army Antiaircraft Command.

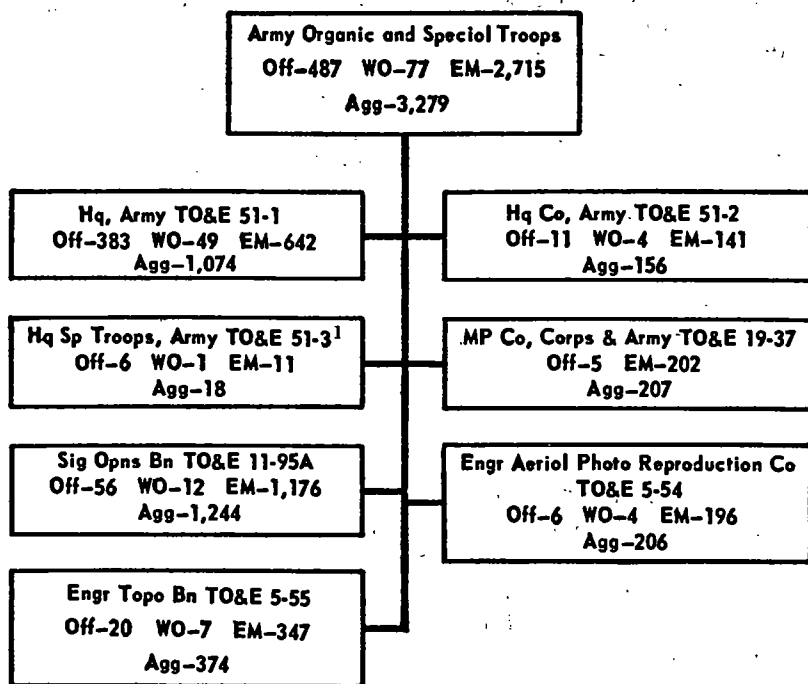


RESTRICTED

RESTRICTED—Security Information**Section II. ARMY, CORPS, TASK FORCE, AND LOGISTICAL COMMAND****3. Army**

a. General. The army is a flexible combat force capable of independent operations. Normally, it consists of a headquarters, organic army troops, two or more corps, and reinforcing combat and service troops. For composition of the branches of a field army see section I, chapter 4.

b. Diagram of Organic Army Troops.

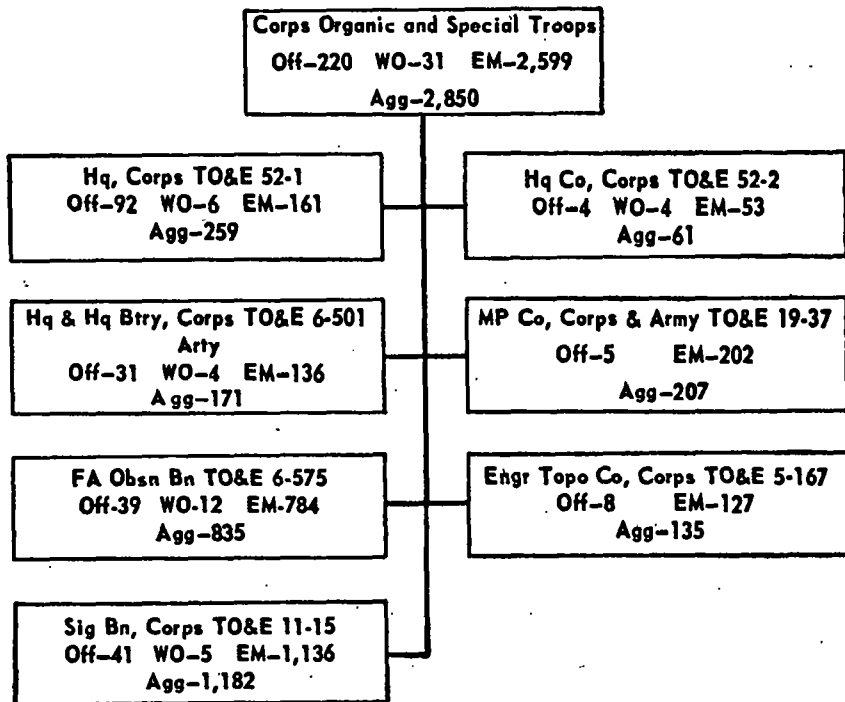


¹Medical service will be provided on an area basis by cellular teams from TO&E 8-500 series as required.

4. Corps

a. General. The corps is a flexible combat force consisting of a headquarters, organic corps troops, two or more divisions, and reinforcing combat and service troops that may be assigned in accordance with its mission. The functions of a corps in an army are primarily tactical. The functions of a separate corps are both tactical and administrative.

b. Diagram of Organic Corps Troops.



5. Task Force

A task force consists of those units (command, intelligence, combat, and service) necessary to carry out certain planned operations (tasks). It has no fixed organization and may be organized from Army, Navy, or Air Force units, or it may be a combination of any two or of all three. A task force designed for one operation might be especially strong in armored units; in another, amphibious units might be predominant.

6. Logistical Commands

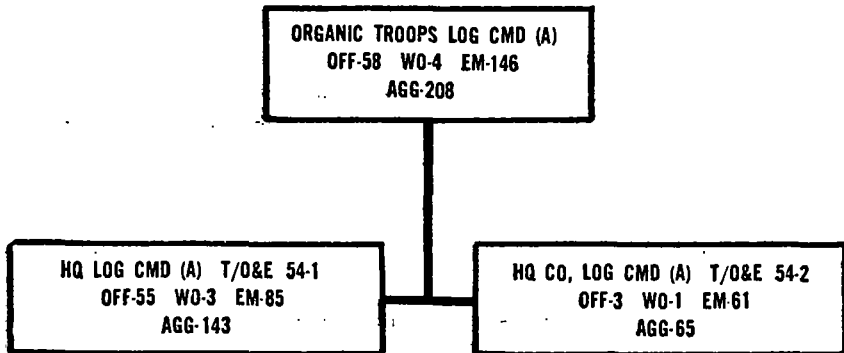
a. General. The logistical command is a flexible administrative headquarters organized to provide logistical support to field armies or smaller units acting independently. The logistical command is normally assigned to the communications zone, but initially may be assigned to an army or an independent task force for the purpose of operating a service command. A headquarters and a headquarters company are organic to the logistical command; additional units are assigned or attached as necessary to accomplish the assigned mission.

RESTRICTED—Security Information

There are three types of logistical commands, each of which has the requisite capabilities for the support of operations of a given size and scope.

b. Logistical Command (A).

(1) Diagram of Logistical Command (A) organic troops.



(2) Capabilities.

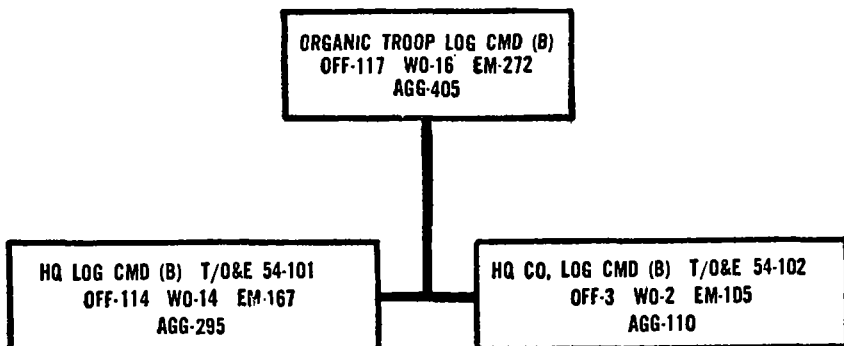
(a) When provided with appropriate service forces, to furnish army and communications zone support to a combat force of approximately 30,000 men (comparable to a reinforced division) by—

1. Operating an army service command.
2. Operating a small section (advance, intermediate, or base) of a communications zone.
3. Operating a major territorial subdivision of one of the above, such as a base, a district, or an area.

(b) Administration and rehabilitation of an area in which civil means are inadequate due to natural disaster or enemy action.

c. Logistical Command (B)

(1) Diagram of Logistical Command (B) Organic troops.



(2) Capabilities.

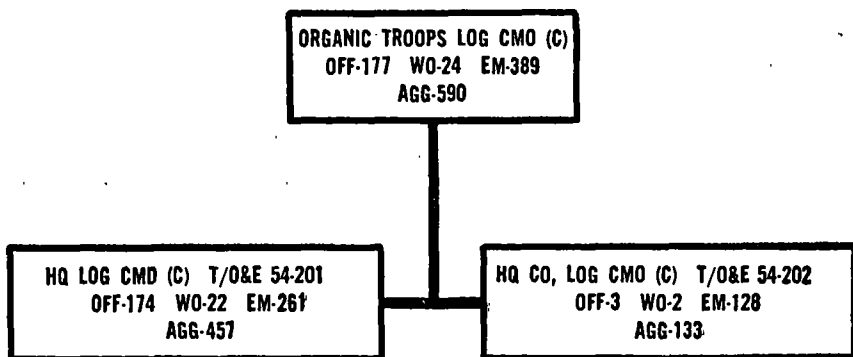
(a) When provided with appropriate service forces, to provide communications zone support to a combat force of approximately 100,000 men (comparable to a reinforced corps) by—

1. Operating a small section (advance, intermediate, or base) of a communications zone.
2. Operating a major territorial subdivision of one of the above, such as a base, a district, or an area.

(b) Administration and rehabilitation of an area in which civil means are inadequate due to natural disaster or enemy action.

d. Logistical Command (C).

(1) Diagram of Logistical Command (C) Organic Troops.



(2) Capabilities.

(a) When provided with appropriate service forces, to provide communications zone support to a combat force of ap-

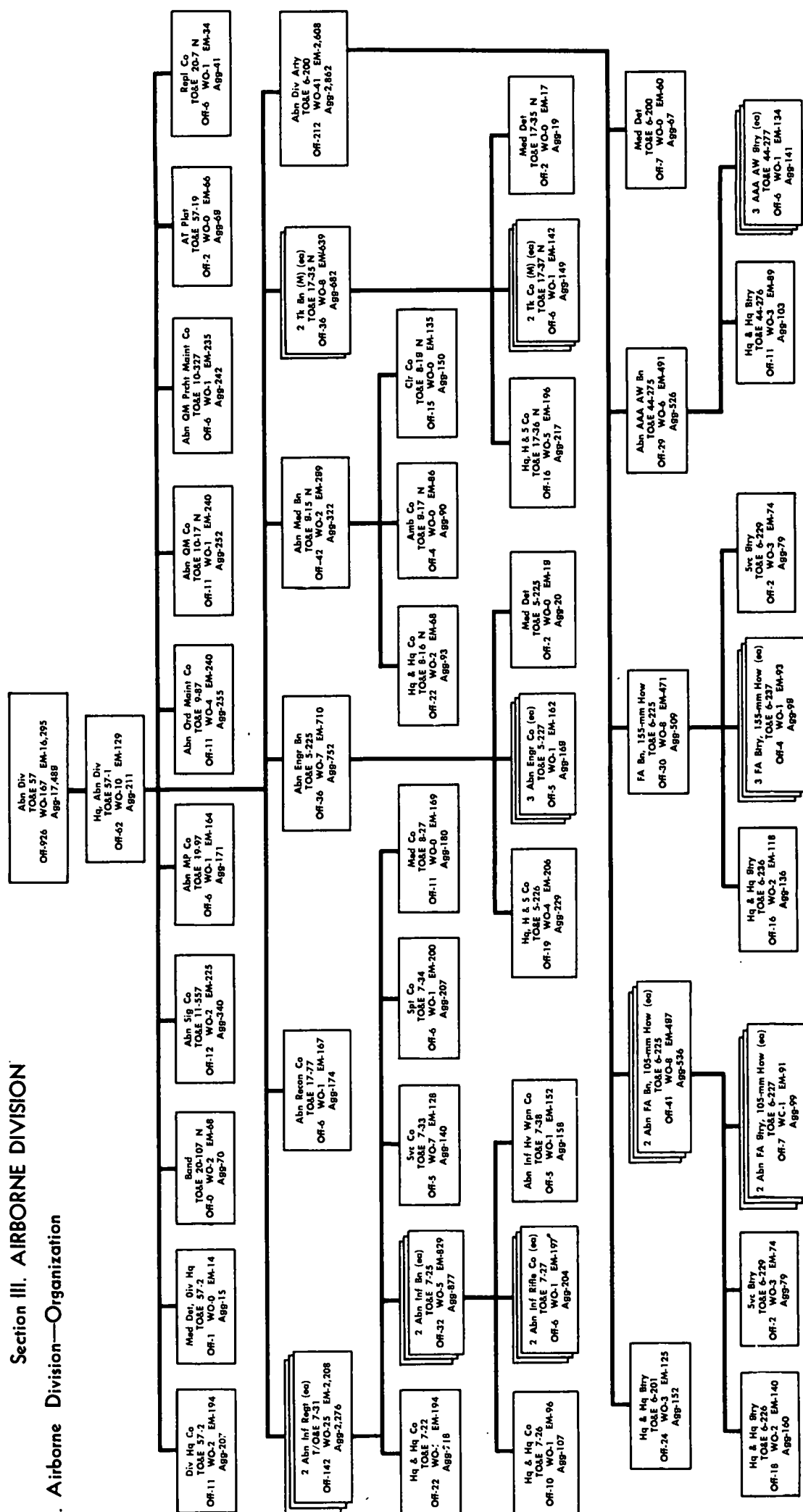
RESTRICTED—Security Information

proximately 400,000 men (comparable to a field army)
by—

1. Operating a section (advance, intermediate, or base) of a communications zone.
 2. Operating a major territorial subdivision of one of the above such as a base, a district, or an area.
 3. Operating a small, undivided communications zone.
- (b) Administration and rehabilitation of an area in which civil means are inadequate due to natural disaster or enemy action.

Section III. AIRBORNE DIVISION.

7. Airborne Division—Organization



Note: Reductions required by C2, SR 210-30-1, 14 Mar 52 have not been applied.

RESTRICTED



RESTRICTED—Security Information

8. Airborne Division—Weapons

1		Div TYP										3 Abn Inf Regt (ea)										Abn Div Arty																																																																					
2		Hq. Abn Div										3 Abn Inf Bn (ea)										Abn Engr Bn										27KbBn(M)(ea)																																																											
3		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
4		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
5		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
6		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
7		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
8		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
9		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
10		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
11		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
12		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
13		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
14		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
15		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
16		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
17		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
18		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
19		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
20		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
21		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
22		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
23		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
24		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
25		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
26		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
27		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
28		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
29		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
30		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
31		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
32		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
33		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
34		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
35		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
36		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
37		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
38		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
39		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
40		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
41		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
42		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
43		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
44		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
45		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
46		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
47		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
48		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
49		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
50		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
51		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
52		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
53		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
54		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
55		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
56		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
57		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
58		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
59		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
60		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
61		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
62		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
63		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
64		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
65		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
66		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
67		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
68		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
69		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
70		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
71		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
72		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
73		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
74		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
75		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
76		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
77		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
78		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
79		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
80		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
81		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
82		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
83		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
84		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
85		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
86		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
87		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
88		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
89		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
90		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
91		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
92		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
93		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
94		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co										AT Plat										Repl Co									
95		Div Hq Co										Band										Abn Sig Co										Abn MP Co										Abn Ord Maint Co										Abn QM Co										Abn QM Pchnt Maint Co																													

! Inclndes med det.

Figures in parentheses are total for units in column heading.

3 Issued in lieu of 105-mm how when authorized by Z1 army commander or table of operations commander.

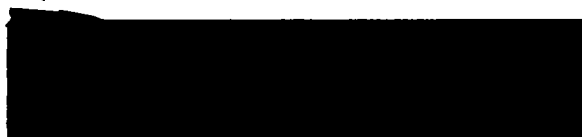
* Figures in parentheses are totals for units indicated in column headings.

261822 O - 53 (Face p. 10) No. 2

RESTRICTED

9. Airborne Division—Vehicles and Major Equipment

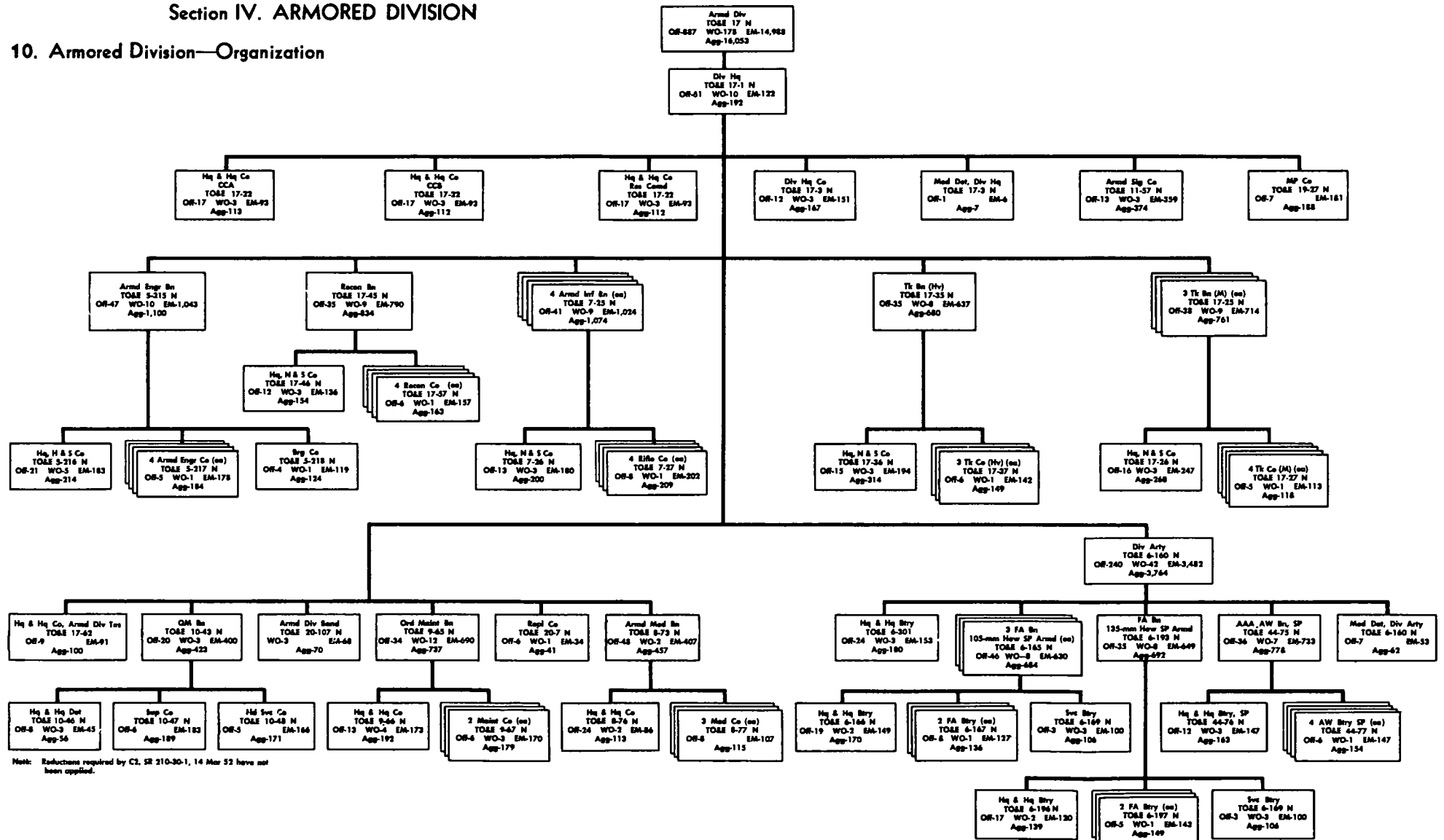
RESTRICTED



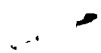
RESTRICTED—Security Information

Section IV. ARMORED DIVISION

10. Armored Division—Organization



RESTRICTED



RESTRICTED—Security Information

11. Armored Division—Weapons

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47		
Units Weapons	Total Arm'd Div ¹	Div Trp						Recon Bn			Arm'd Engr Bn				Tk Bn (hv)		Arm'd Inf Bn (4 ea)			M Tk Bn (3 ea)			Div Arty															Hq & Hq Co Div Tns	Arm'd Div Band	Repl Co	QM Bn				Ord Bn			
		Div Hq	Hq Co, Arm'd Div	Arm'd Sig Co	MP Co	Hq & Hq Co, C Comd (ea)	Hq & Hq Co, Res Comd	Total Bn	Hq, Hq & Svc Co	4 Recon Co (ea)	Total Bn	Hq, Hq & Svc Co	Brg Co	4 Arm'd Engr Co (ea)	Total Bn	Hq, Hq & Svc Co	3 Hv Tk Co (ea)	Total Bn	Hq, Hq & Svc Co	4 Rifle Co (ea)	Total Bn	Hq, Hq & Svc Co	4 M Tk Co (ea)	Total Div Arty	Hq & Hq Btry	FA Bn, 105-mm How, SP, Arm'd (3ea)				FA Bn, 155-mm How, SP, Arm'd				AAA AW Bn, SP			Total Bn				Hq & Hq Btry	4 AAA AW Btry SP(ea)	Hq & Hq Det	Sup Co	Fld Svc Co	Total Bn	Hq & Hq Co	3 Maint Co (ea)
																										Total Bn	Hq & Hq Btry	3 FA Btry (ea)	Svc Btry	Total Bn	Hq & Hq Btry	3 FA Btry (ea)	Svc Btry	Total Bn	Hq & Hq Btry	4 AAA AW Btry SP(ea)												
2 Carbine, cal .30 ²	8, 118	151	138	281	78	61	61	(331)	103	57	(157)	61	32	16	(282)	126	52	(328)	120	52	(313)	141	43	(3, 147)	99	(627)	112	108	98	(537)	115	139	98	(630)	122	127	148	70	41	(213)	45	84	84	(647)	155	164		
3 Gun, AA, 40-mm, twin ¹	32																	(38)	2	9	(1)	1																										
4 Gun, machine, cal .30, hv ¹	168							(12)		3					(1)	1		(38)	2	9	(1)	1																										
5 Gun, machine, cal .30, lt ^{1, 3}	304		3			3	3	(29)	5	6	(28)	2	2	6	(11)	11		(45)	9	9	(13)	13																										
6 Gun, machine, cal .50 ^{1, 3}	326		2	18	2	1	1	(17)	5	3	(32)	11	13	2	(13)	10	1	(9)	5	1	(15)	11	1		(66)	5	(13)	3	2	4	(13)	3	2	4	(9)	5	1	3		1	(32)		14	18	(56)	20	17	
7 Gun, multiple, cal .50 (4 guns ea) ¹	32																																															
8 Gun, submachine, cal .45 ²	2, 399	5	48	91	50	27	27	(104)	36	17	(117)	30	3	21	(146)	53	31	(123)	31	23	(159)	67	23		(660)	37	(123)	37	26	8	(115)	29	26	8	(139)	35	26	38			(18)	6	6	6	(72)	30	14	
9 Gun, tk, 75-mm ¹																																																
10 Gun, tk, 76-mm ¹	58		3			3	3	(30)	2	7					(2)	2		(2)	2		(2)	2																										
11 Gun, tk, 90-mm ¹	297							(12)					3		(69)	3	22				(72)	4	17																									
12 How, 105-mm ¹	54																																															
13 How, tk, 105-mm ¹	18																				(6)	6			(54)		(18)		6																			
14 How, 155-mm ¹	18																																															
15 Launcher, rkt, 2.36-in ¹	160																	(40)		10																												
16 Launcher, rkt, 3.5-in ¹	494		8	24	4	8	8	(36)	12	6	(44)	4	4	9	(18)	12	2	(17)	17		(23)	15	2		(158)	6	(39)	13	8	2	(35)	9	8	2				5		4	(15)	3	6	6	(17)	5	4	
17 Mort, 60-mm ¹	51																	(12)		3					(3)		(1)	1																				
18 Mort, 81-mm ^{1, 4}	32							(12)		3					(1)	1		(4)	4		(1)	1																										
19 Pistol, auto, cal .45 ²	3, 115	25	41	2	102	19	19	(151)	11	35	(65)	5		15	(356)	26	116	(91)	19	18	(400)	60	85		(473)	38	(112)	39	24	1	(96)	35	20	1	(3)	3		9			(3)	3			(267)	63	68	
20 Rifle, auto, cal .30 ²	167		3					(12)		3					(1)	1		(37)	1	9	(1)	1																										
21 Rifle, cal 30, M1 ²	3, 056		27		36	5	5	(263)	7	64	(753)	117	88	137	(19)	19		(420)	32	97	(23)	23																										
22 Rifle, cal .30 (sniper) ²	144																	(36)		9																												
23 Rifle, 75-mm, M20 ¹	3		3																																													
24																																																
25 Crew-served weapons ¹	2, 047		19	42	6	15	15	(136)	24	28	(116)	17	19	20	(115)	40	25	(167)	39	32	(133)	53	20		(363)	11	(71)	17	16	6	(66)	12	16	6	(73)	5	17	13		5	(47)	3	20	24	(73)	25	16	
26 Individual weapons ²	16, 999	181	257	374	266	112	112	(861)	157	176	(1, 092)	213	123	189	(804)	225	193	(1, 035)	203	208	(896)	292	151		(4, 280)	174	(862)	188	189	107	(748)	179	154	107	(772)	160	153	206	70	41	(417)	56	190	171	(966)	248	246	
27 Total weapons	19, 046	181	276	416	272	127	127	(997)	181	204	(1, 208)	230	142	209	(919)	265	218	(1, 202)	242	240	(1, 029)	345	171		(4, 643)	185	(933)	205	205	113	(814)	191	170	113	(845)	165	170	219	70	46	(464)	59	210	195	(1, 059)	273	262	

¹ Includes medical detachment.
² Includes both W/ and W/O winch.
³ Does not include machine guns mounted on combat vehicles.
⁴ Does not include mortars mounted on tank recovery vehicle but does include mortars carried on carriage, half-track.
⁵ Figures in parentheses are totals for units indicated in column heading.

RESTRICTED

12. Armored Division—Vehicles and Major Equipment

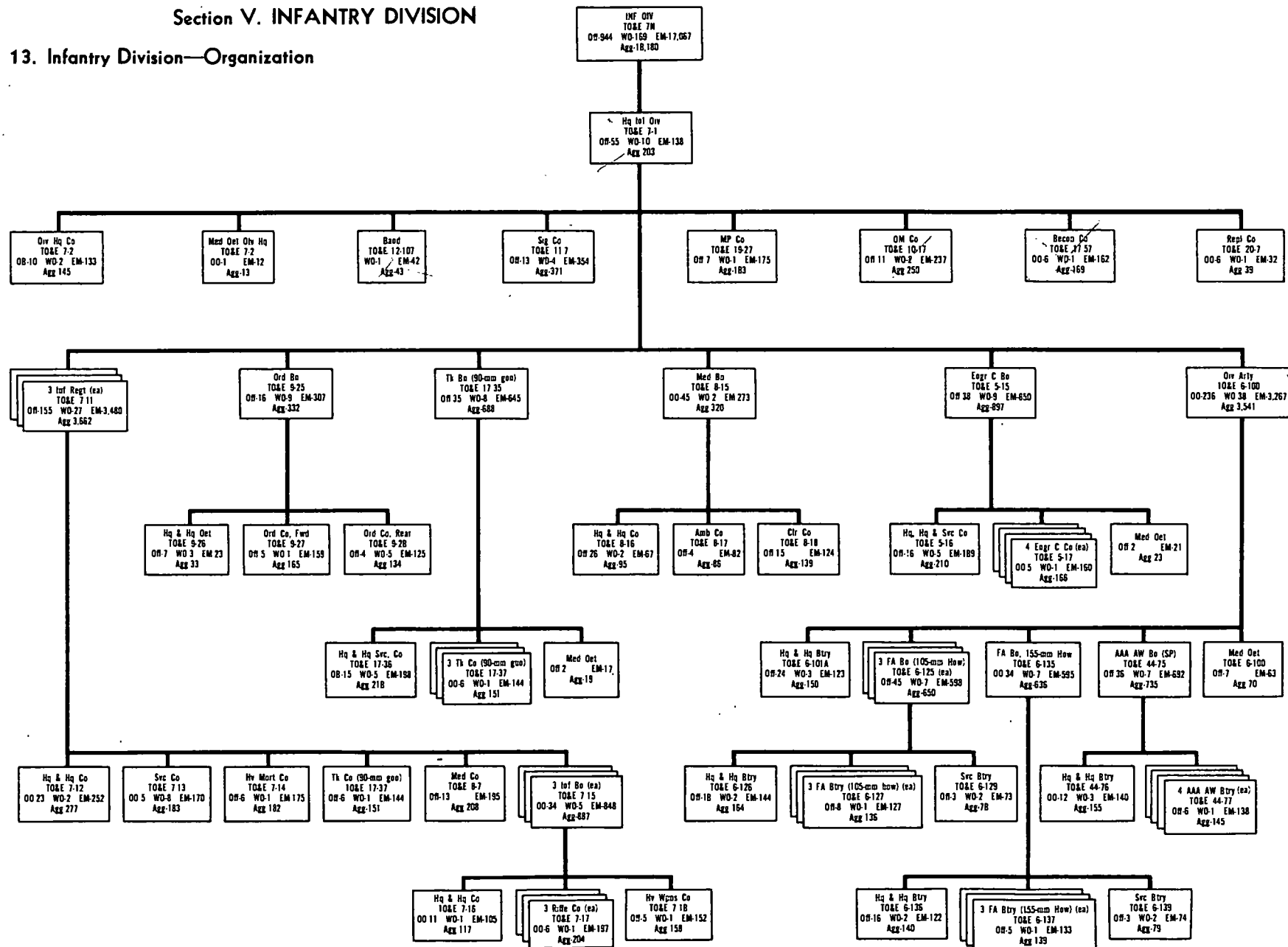
¹ Includes medical detachment.
² Includes both W/ and W/O which.



RESTRICTED—Security Information

Section V. INFANTRY DIVISION

13. Infantry Division—Organization



RESTRICTED

RESTRICTED—Security Information

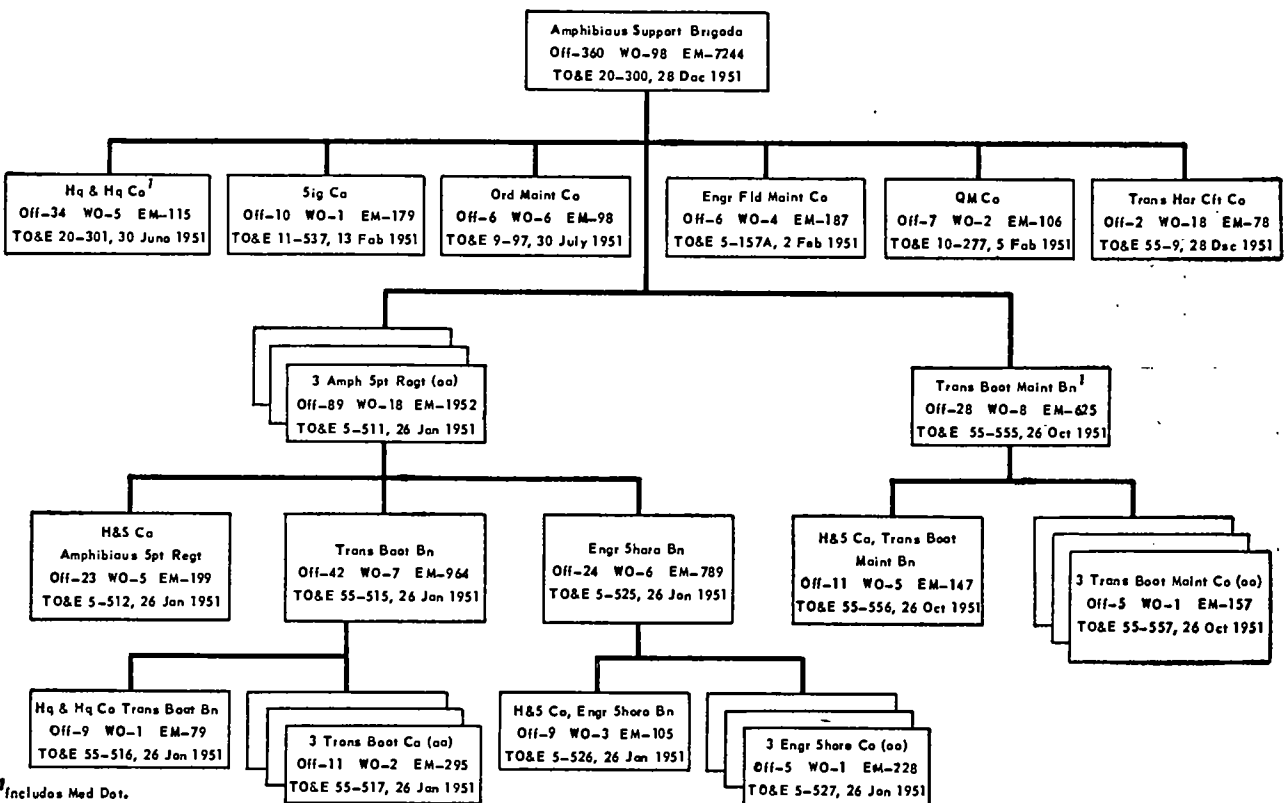
14. Infantry Division—Weapons^{1 2 3}

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47				
		Div Trp										Inf Regt (3 ea)										Tk Bn (90-mm gun)		Engr C Bn		Div Arty																									
												Ordn Maint Bn					Med Bn																			FA Bn, 105-mm How (3 ea)					FA Bn, 155-mm How					AAA AW Bn					
	Units	Total Inf Div	Div Hq	Hq Co., Inf Div	Inf Div Band	Sig Co	MP Co	QM Co	Recon Co	Repl Co	Total Bn	Hq & Hq Det	Ordn Co, Fwd	Ordn Co, Rear	Total Bn	Hq & Hq Co	Antib Co	Car Co	Total Regt	Hq & Hq Co	Svc Co	Hvy Mort Co	Tk Co (90-mm gun)	Med Co	Total Bn	Hq & Hq Co	3 Rifle Co (ea)	Hvy Wpns Co	Total Bn	Hq, H & S Co	3 Tk Co (90-mm gun) (ea)	Total Bn	Hq, H & S Co	4 Engr C Co (ea)	Total Div Arty	Hq & Hq Btry	Total Bn	Hq & Hq Btry	3 FA Btry (ea)	Svc Btry	Total Bn	Hq & Hq Btry	3 FA Btry (ea)	Svc Btry	Total Bn	Hq & Hq Btry	4 AAA AW Btry (ea)				
Weapons																																																			
2 Cbn, Cal .30		5,508	113	23	13	212	43	150	61	27	(163)	15	72	76	(126)	38	36	52	(796)	62	15	55	53	74	(179)	29	29	63	(283)	118	53	(123)	51	16	(1,750)	57	(280)	67	55	48	(237)	56	45	46	(592)	116	119				
3 Gun, 40-mm twin		32																																																8	
4 Gun, machine, Cal .30, Hvy		36																		(12)						(4)		4																							
5 Gun, machine, Cal .30, Lt		309					3		9		(10)		10							(69)	3					(22)		6	4	(12)	12	(26)	2	6	(42)	2	(10)	2	2	2	(10)	2	2	2							
6 Gun, machine, Cal .50		322		5		7	1	11	3	1	(11)		6	5						(48)	4	13	6	1		(8)	3	1	2	(13)	10	1	(28)	12	4	(98)	2	(21)	6	4	3	(20)	5	4	3	(13)	5	2			
7 Gun, machine, Cal .50, multiple mount (4 guns)		32																																																	
8 Gun, submachine, Cal .45		970		5		58	56	4	20		(50)	4	36	10						(37)	5		32							(159)	63	32	(48)	24	6	(459)	28	(77)	33	13	5	(61)	26	10	5	(139)	35	26			
9 Gun, 76-mm		9							7																						(2)	2																			
10 Gun, 90-mm		135																		(22)			22							(69)	3	22																			
11 How, 105-mm		54																																																	
12 How, 155-mm		18																																																	
13 Launcher, Rkt, 3.5-in		557		6		10	3	5	6	4	(6)	1	3	2						(83)	7	10	4	2		(20)	5	3	6	(18)	12	2	(40)	4	9	(210)	3	(39)	7	10	2	(38)	6	10	2	(52)	8	11			
14 Mort, 60-mm		81																		(27)						(9)		3																							
15 Mort, 81-mm		39							3											(12)						(4)		4																							
16 Mort, 4.2-in		36																		(12)		12																													
17 Pistol, Auto, Cal .45		2,163	28	14		14	105	3	35		(7)	5	1	1	(10)	2	1	7	(508)	7	1	21	110	3	(121)	3	30	28	(357)	26	110	(7)	6		(59)	10	(10)	6	1	1	(10)	6	1	1	(3)	3					
18 Rifle, Cal .30, M1		8,869	54	107		87	69	93	61	12	(112)	9	56	47	(24)	7	6	11	(2,096)	200	167	103		27	(533)	85	127	67	(21)	18		(707)	128	144	(1,234)	52	(283)	58	67	24	(328)	52	83	27							
19 Rifle, Cal .30 M1C (sniper)		243																		(81)						(27)		9																							
20 Rifle, Auto, Cal .30		250		3					3											(81)						(27)		9		(1)	1																				
21 Rifle, 57-mm, M18		51																		(27)						(9)		3																							
22 Rifle, 75-mm, M20		39		3																(12)						(4)		4																							
23 Individual Wpns		17,753	195	149	43	371	273	250	180	39	(332)	33	165	134	(160)	47	43	70	(3,518)	274	183	182	195	104	(860)	117	195	158	(820)	225	195	(885)	209	166	(3,502)	147	(650)	164	136	78	(636)	140	139	79	(734)	154	145				
24 Crew-served Wpns		2,030		17		17	7	16	31	5	(27)	1	19	7						(405)	14	23	22	25		(107)	8	25	24	(115)	40	25	(94)	18	19	(486)	7	(88)	15	22	7	(86)	13	22	7	(129)	13	29			
25 Total Wpns		19,783	195	166	43	388	277	266	211	44	(359)	34	181	141	(160)	47	43	70	(3,923)	288	206	204	220	104	(967)	125	220	182	(935)	265	220	(979)	227	185	(3,988)	154	(738)	179	158	85	(722)	153	161	86	(863)	167	174				

¹ Includes Medical Detachment.
² Does not include weapons mounted in combat vehicles.
³ Figures in parentheses are totals for unit indicated in column heading.

Section VI. AMPHIBIOUS SUPPORT BRIGADE

16. Amphibious Support Brigade—Organization



RESTRICTED

17. Amphibious Support Brigade—Weapons

1	2	3	4	5	6	7	8	9	10	
	Total Brigade	Amphibious Support Brigade (T/O & E 20-300)								
		Hq & Hq Co (T/O & E 20-301)	Signal Co (T/O & E 11-537)	Ord Co (T/O & E 9-97)	Engr Fld Maint Co (T/O & E 5-157A)	Quartermaster Co (T/O & E 10-277)	Trans Harbor Crft Co (T/O & E 55-9)	3 Amphib ^s Spt Regt (ea) (T/O & E 5-511)	Trans Boat Maint Bn (T/O & E 55-555)	
2	Carbine, cal .30.....	5,253	76	137	84	162	86	98	1,363	521
3	Gun, machine, cal .30.....	36	---	---	---	---	---	---	12	---
4	Gun, machine, cal .50, AN-M3 aircraft, basic.....	286	---	---	---	---	16	90	---	---
5	Gun, machine, cal .50, flexible.....	55	1	4	5	3	4	---	10	8
6	Gun, submachine, cal .45.....	245	19	18	12	10	9	---	49	30
7	Launcher, rocket, 3.5 in.....	145	2	3	2	4	2	---	40	12
8	Pistol, auto, cal .45.....	69	19	3	2	1	2	---	13	3
9	Rifle, cal .30, M-1.....	1,904	19	32	12	24	18	---	567	98
10	Rifle, 75-mm, M20.....	18	---	---	---	---	---	---	6	---

18. Amphibious Support Brigade—Vehicles and Major Equipment

1	2	3	4	5	6	7	8	9	10
1	Total brigade	Amphibious Spt brigade, T/G & E 20-300							
		Hq & Hq Co (T/O & E 20-301)	Signal Co (T/G & E 11-537)	Ord Co (T/O & E 9-97)	Engr Fld Maint Co (T/O & E 5-157A)	Quarter- master Co (T/O & E 10-277)	Trans Harbor Cft Co (T/O & E 55-9)	3 Amphib Spt Regts (ea) (T/O & E 5-511)	Trans Boat Maint Bn (T/O & E 55-555)
2	E Compressor, air, set No. 1, 55 cfm.....	10							10
3	E Compressor, air, trailer mounted, 500 cfm.....	3						1	
4	E Compressor, air, truck mounted, 105 cfm.....	18						6	
5	E Crane, nonrevolving, wheeled, 40,000 lb capacity, 20 ft boom.....	19						3	10
6	E Crane-sbovel, Crawler, 7-10 ton, ¾ cu yd.....	15						5	
7	E Crane-sbovel, power unit, revolving truck mounted, 20 ton, ¾ cu yd.....	17			1			3	7
8	E Firefighting equipment, set No. 2.....	3						1	
9	E Firefighting equipment, with Truck, Set No. 18, 500 GPM.....	3						1	
10	E Generator set, portable, diesel driven, skid mounted, 15 KW.....	5			2				3
11	E Generator set, Portable, gasoline driven, skid mounted, 2 KVA.....	11							11
12	E Grader, road, motorized, diesel.....	6						2	
13	E Grader, road, towed.....	3						1	
14	E Hammer, pneumatic or steam, piledriver, 5,000 lb.....	3						1	
15	E Lubricator, trailer mounted.....	4			1			1	
16	E Power plant, trailer mounted, 5 KW.....	3							3
17	E Pump, centrifugal, gasoline driven, tlr mounted, 4" suction, 500 GPM.....	4							4
18	E Roller, road, towed.....	3						1	
19	E Rooter, road, cable operated.....	3						1	
20	E Scraper, road, towed, cable operated, 12 cu yd.....	9						3	
21	E Semitrailer, front loading, low bed, 20 ton.....	26			1			7	4
22	E Shop equipment, base maint, Set No. 1, electrical.....	1							1
23	E Shop equipment, base maint, Set No. 3, general repair.....	1							1
24	E Shop equipment, base maint, Set No. 4, machine shop.....	1							1
25	E Shop equipment, base maint, Set No. 5, motor.....	1							1
26	E Shop equipment, motorized, electrical repair.....	1			1				
27	E Shop equipment, motorized, general purpose repair.....	15			3			1	9

RESTRICTED—Security Information

18. Amphibious Support Brigade—Vehicles and Major Equipment—Continued

	1	2	3	4	5	6	7	8	9	10
		Total brigade	Amphibious Spt brigade, T/O & E 20-300							
			Hq & Hq Co (T/O & E 20-301)	Signal Co (T/O & E 11-537)	Ord Co (T/O & E 9-97)	Engr Fld Maint Co (T/O & E 5-157A)	Quarter- master Co (T/O & E 10-277)	Trans Harbor Cft Co (T/O & E 55-9)	3 Amphib spt Regts (ea) (T/O & E 5-511)	Trans Boat Maint Bn (T/O & E 55-555)
28	E Shop equipment, motorized, machine shop, heavy.....	4				1				3
29	E Shop equipment, motorized, small tool repair.....	1				1				
30	E Shop equipment, motorized, tool and bench.....	1				1				
31	E Shop equipment, motorized, Set No. 8, Welding.....	11				1				10
32	E Tractor, crawler, with bulldozer, rigid.....	18							6	
33	E Tractor, crawler, diesel driven, with bulldozer, tilting, cable operated.....	55							15	10..
34	E Water purification equipment, Set No. 3, 35 GPM.....	6							2	
35	E Welding equipment, Set No. 1, electric, 300 amp, trailer mounted.....	28				3			7	4
36	E Welding equipment, Set No. 2, oxyacetylene.....	3								3
37	E Welding equipment, Set No. 3, under water, oxy arc cutting.....	1								1
38	O Aircraft, helicopter.....	3	3							
39	O Aircraft, multi-passenger, fixed wing.....	1	1							
40	O Aircraft, two-place, fixed wing.....	1	1							
41	O Semitrailer, 6 ton, 2W, van.....	6				6				
42	O Trailer, ¼ ton, 2W, cargo.....	125	14	13	8	5	6		24	7
43	O Trailer, 1 ton, 2W, cargo.....	188	3	24	20	10	24	1	28	22
44	O Trailer, 1 ton, 2W, water tank, 250 gal.....	36	1	1	1	1	1		9	4
45	O Trailer, 2 ton, 4W, generator, M18.....	5				2				3
46	O Truck, ¼ ton.....	200	18	16	8	5	6	1	43	17
47	O Truck, ¾ ton.....	63	3	6	4	5	3		9	15
48	O Truck, 2½ ton, amphibian.....	45							12	9
49	O Truck, 2½ ton, cargo.....	221	3	26	21	6	23	1	37	30
50	O Truck, 2½ ton, electrical repair.....	1			1					
51	O Truck, 2½ ton, machine shop load A.....	1			1					
52	O Truck, 2½ ton, shop van.....	2			2					

53	O Truck, 2½ ton, Signal Corps Repair.....	2	2						
54	O Truck, 4 ton, dump.....	90						30	
55	O Truck, 4 ton, wrecker.....	3						1	
56	O Truck, 4-5 ton, tractor.....	3			3				
57	O Truck, 6 ton, wrecker.....	8		3	1			1	1
58	O Truck, 6 ton, prime mover.....	1			1				
59	O Truck, 6 ton, tractor.....	25						7	4
60	T Barge, liquid cargo, steel, 120 ft.....	3					3		
61	T Barge, liquid cargo, self-propelled, diesel, 182 ft, 6,500 bbls.....	1					1		
62	T Boat, lighter, tank, 56 ft, LCM (6).....	9							9
63	T Boat, passenger and cargo, diesel, 65 ft.....	20					2	6	
64	T Boat, patrol, gasoline, 37 ft.....	24						8	
65	T Boat, patrol and rescue, 63 ft.....	9						3	
66	T Boat, utility, diesel, wood, 26 ft.....	4							4
67	T Crane, floating, revolving, diesel, steel, 60 ton.....	1							1
68	T Landing craft, steel, two engine, diesel LCM (6).....	387						129	
69	T Tug, harbor, diesel, steel, 1,200 hp, 100 ft.....	1					1		
70	T Vessel, supply, diesel, steel, 176 ft.....	1					1		

CHAPTER 2**PERSONNEL**

Section I. GENERAL**19. General**

This chapter provides personnel data for general staff officers on division, corps, army, communications zone sections, communications zone, and theater staffs within a theater of operations.

a. Section I outlines the contents of the chapter.

b. Section II enables the staff officer to estimate losses and the requirements for replacements in—

(1) Combat zone forces of division size or greater both for short periods of a particular type of combat action and for longer periods containing a variety of types of action.

(2) The communications zone.

(3) Theaters of operation. Two methods of varying accuracy are given. In each case, loss estimates are given for the unit concerned as a whole with breakdowns by branch of service.

c. Section III gives a basis for estimates of prisoners of war by giving experience data under varying conditions of World War II.

d. Section IV gives a basis for estimates of decorations and mail by giving experience data from World War II.

e. Section V guides the staff officer in making the internal arrangements of division, corps, and army headquarters.

Section II. LOSSES AND REPLACEMENTS***20. General**

A personnel loss is any reduction in the assigned strength of a unit. These losses are caused primarily by enemy action, disease, accidents, and administrative action. The rate of loss varies with the theater of operations, climate, terrain, condition and state of training of troops, type of activity, the enemy, and numerous other factors. Each division and corps has its own loss experience dependent upon its own situation. Loss rates by arm or service, and by military occupational specialty within corps and divisions vary with the amount of exposure of the particular category of personnel to the various causes of losses.

*Losses and strengths considered herein do not include Air Force personnel.

a. Categories of Losses. Personnel losses result from three general categories:

(1) *Casualties.* Those losses incurred in action including—

- (a) Killed in action.
- (b) Died of wounds and injuries received in action.
- (c) Wounded or injured in action.
- (d) Missing in action or captured by the enemy.

(2) *Nonbattle losses.* These losses include—

- (a) Dead, nonbattle.
- (b) Missing, nonbattle.
- (c) Evacuated sick and injured, nonbattle.

(3) *Administrative losses.* Attrition from this category is relatively small and dependent upon current administrative policies. These losses include—

- (a) Transfers to other units, disciplinary barracks, etc.
- (b) Absent without leave and desertion.
- (c) Rotational personnel.
- (d) Discharges.

b. Gross Losses. In addition to those killed, captured, or missing, gross losses include those evacuated to hospitals and dropped from the rolls of their units. In division, corps, and army units, any man evacuated to an evacuation hospital or general hospital is dropped from unit rolls and carried on the rolls of the Department of the Army Medical Holding Detachment and is not chargeable against the authorized theater strength. In the communications zone, men are dropped from unit rolls after they remain in hospitals over 90 days or when it is foreseen that they will be hospitalized in excess of 90 days.

c. Net Losses. Net losses are gross losses less those returned to duty within the theater. Net losses are computed only at theater level and are used as a basis for estimates of personnel required from the zone of interior to maintain theater strength.

d. Loss Experience. Factors and figures which appear in the tables of this section are based primarily upon World War II experience and will not apply necessarily during another war. For future planning, loss experience of past wars must be modified by evaluating new factors applicable to new conditions. As a war progresses, every echelon of command gradually builds up loss experience which more accurately reflects the current conditions. *It is emphasized that even the most complete and accurate figures relating to past wars should not be relied upon as valid for any future war.* With past experience as a basis, good judgment and sound knowledge of principles must be used to develop new experience tables applicable to new conditions. Administrative losses are based on changing policies and are not

adaptable to the establishment of loss tables based on past experience. For this reason, experience tables for administrative losses are not included in this manual.

21. Combat Zone Estimates

a. General. Personnel loss estimates at corps and division levels are used to anticipate the effect of losses on the tactical plan and to prepare for the handling of replacements within the commands. The estimates must answer three questions—the strength at any given time, the losses to be anticipated for a specific situation, and the distribution of these losses by arm or service and military occupational specialty. Corps and division combat estimates are of two types—short-period estimates (5 days or less), and long-period estimates (over 5 days). Estimates at army level are used for the same purposes as at corps and division levels. In addition, they are used as a basis for allocation of available replacements and to inform higher headquarters of anticipated replacement requirements. Army headquarters use both short-period estimates (5 days or less) and long period estimates (over 5 days).

b. Factors. In calculating losses, there are two major factors to be considered—

- (1) Loss rates applicable to the specific situation are expressed as percent of strength or as number per thousand of average strength of any given period. In compilation and use of loss data, units whose loss rates are about the same because of similar operating conditions, are grouped together.
- (2) Loss rates are applied to the strength of the particular command under consideration. There are two different strengths used—
 - (a) *Authorized strength* is table of organization and equipment strength plus any additional personnel authorized by higher headquarters. Authorized strength is used in long-range planning and when the assigned strength is unknown or unstable.
 - (b) *Assigned strength* includes all personnel carried as assigned on the unit's roster. Assigned strength is used when known in long-period estimates if it differs materially from authorized strength and if it will remain stable during the estimate period.

c. *Short-Period Estimates* (periods not in excess of 5 days).

(1) *Daily personnel losses as percent of strength.* (Do not use this table for loss-estimate periods over 5 days):

	1	2	3	4	5	6	7	8	9	10
	General type of operations for the force as a whole	Front line divisions			Divisions in corps and army reserve			Nondivisional units, corps, and army ¹		
1		Casualty per-centage	Nonbattle per-centage	Total per-cent-age	Casualty per-centage	Nonbattle per-centage	Total per-cent-age	Casualty per-centage	Nonbattle per-centage	Total per-cent-age
2	Covering, and security force action.....	0.9	0.3	1.2	0.3	0.3	0.6	0.3	0.1	0.4
	ATTACK:									
3	Meeting engagement.....	2.4	0.3	2.7	0.3	0.3	0.6	0.4	0.1	0.5
4	Of a position—1st day.....	3.8	0.3	4.1	0.4	0.3	0.7	0.5	0.1	0.6
5	Succeeding days.....	1.9	0.3	2.2	0.3	0.3	0.6	0.4	0.1	0.5
6	Of a fortified zone—1st day.....	6.3	0.3	6.6	0.5	0.3	0.8	0.7	0.1	0.8
7	Succeeding days.....	3.2	0.3	3.5	0.4	0.3	0.7	0.5	0.1	0.6
	DEFENSE:									
8	Meeting engagement.....	1.5	0.3	1.8	0.3	0.3	0.6	0.3	0.1	0.4
9	Of a position—1st day.....	1.9	0.3	2.2	0.3	0.3	0.6	0.4	0.1	0.5
10	Succeeding days.....	1.0	0.3	1.3	0.3	0.3	0.6	0.3	0.1	0.4
11	Of a zone—1st day.....	3.2	0.3	3.5	0.4	0.3	0.7	0.5	0.1	0.6
12	Succeeding days.....	1.6	0.3	1.9	0.3	0.3	0.6	0.4	0.1	0.5
13	Inactive situation ²	0.7	0.3	1.0	0.3	0.3	0.6	0.3	0.1	0.4
14	Pursuit.....	1.3	0.3	1.6	0.3	0.3	0.6	0.3	0.1	0.4
15	Retirement and delaying action.....	0.7	0.3	1.0	0.3	0.3	0.6	0.3	0.1	0.4

¹ Use divisional loss rates for units attached to a division.

² Forces in contact—neither side attacking.

(2) *Distribution of casualties by branch (divisions):*

	1	2	3	4
1	Branch	Infantry division (percentage)	Armored division (percentage)	Airborne division (percentage)
2	Infantry.....	93.0	62.0	85.6
3	Artillery.....	2.4	3.6	6.9
4	Armor.....	2.0	23.1	0
5	Engineers.....	1.5	3.3	3.9
6	All others.....	1.1	8.0	3.6

(3) *Distribution of infantry casualties by selected military occupational specialty within an infantry division.* The combat effectiveness of an infantry division is most seriously affected by the personnel losses of its nine infantry battalions. A total of 87.4 percent of the infantry casualties occur among riflemen and heavy weapons crewmen (and closely allied specialists) who constitute the larger portion of the infantry battalion's strength.

RESTRICTED—Security Information

(4) *Distribution of nonbattle losses.* Nonbattle losses in each branch are in the same proportion to the total nonbattle losses as the strength of that branch is to the total strength of the unit.

(5) *Example.* Calculate the total losses of a front line infantry division in the first 3 days of the defense of a position and determine the number of infantry riflemen and heavy weapons crewmen who become casualties.

(a) *Total losses.*

Authorized strength of division (T/O & E).....	18,187
Assigned strength of division (assumed), beginning of first day.....	18,000
Losses, first day, defense of position ($2.2\% \times 18,000$ —(1) above, line 9, column 4).....	396
Assigned strength, end of first day.....	17,604
Losses, second day, defense of position ($1.3\% \times 17,604$ —(1) above, line 10, column 4).....	229
Assigned strength, end of second day.....	17,375
Losses, third day, defense of position ($1.3\% \times 17,375$ —(1) above, line 10, column 4).....	226
Assigned strength, end of third day.....	17,149
Total losses, 3 days ($396 + 229 + 226$).....	851

(b) *Casualties.*

First day, defense of position ($1.9\% \times 18,000$ —(1) above, line 9, column 2).....	342
Second day, defense of position ($1.0\% \times 17,604$ —(1) above, line 10, column 2).....	176
Third day, defense of position ($1.0\% \times 17,375$ —(1) above, line 10, column 2).....	174
Total casualties.....	692

(c) *Infantry casualties* ($93\% \times 692$ —(2) above, line 2, column 2).....

Infantry riflemen and heavy weapons crewmen casualties ($87.4\% \times 644$ —(3) above).....	563
---	-----

d. *Long-Period Estimates—Combat Zone* (periods in excess of 5 days).

(1) *Monthly personnel losses:*

	1	2	3
1	Troops	Percent per month	Nonbattle losses percent per month
2	Infantry divisions in combat zone.....	10	8
3	Armored divisions in combat zone.....	8	7
4	Corps and army nondivisional troops in combat zones.....	1.25	3.0

(2) *Types of casualties as percent of total casualties.*

	1	2	3	4
1	Casualties	Infantry divisions percent	Armored divisions percent	Corps and army nondivisional units percent
2	Killed.....	16.5	18.0	16.0
3	Wounded.....	70.0	72.0	84.0
4	Captured and missing.....	13.5	10.0	Negligible

(3) *Distribution of losses by branch within divisions.* See c(2) and (4) above.

(4) *Distribution of casualties by branch within corps and larger units in the combat zone as percent of total casualties—*

	1	2
1	Branch	Percent
2	Infantry.....	81.9
3	Artillery.....	4.5
	Field.....	(3.6)
	Antiaircraft.....	(0.9)
4	Armor.....	6.6
5	Corps of Engineers.....	3.2
6	Army Medical Service.....	2.8
7	Signal Corps.....	0.2
8	Quartermaster Corps.....	0.1
9	Ordnance Corps.....	0.2
10	Transportation Corps.....	
11	Chemical Corps.....	0.3
12	Military Police Corps.....	0.1
13	Miscellaneous.....	0.1

Note. The percentage figures given in this table are the field force casualty distribution as reported through Machine Record Unit channels, European Theater of Operations, for the period 6 June 1944 through 31 March 1945. The figure for Armor combines the percentages originally reported as Armored Forces (2.9 percent), Tank Destroyer (1.4 percent), and Cavalry (2.3 percent). *In actual operations, the distribution of casualties by branch varies with the composition of the force, type of operation, etc.*

(5) *Distribution of nonbattle losses.* See c(4) above.

(6) *Example.* Calculate the number of replacements required to bring I Corps up to authorized strength and to maintain it at that strength in combat for 15 days, given—

	Authorized strength	Assigned strength
Three infantry divisions.....	54,561	50,000
One armored division.....	16,053	15,000
Corps nondivisional troops.....	29,300	27,000
Total corps.....	99,914	92,000

(a) *Replacements needed now.*
Authorized (99,914)—assigned (92,000)----- 7,914

(b) *Estimated losses, 15 days.*
Infantry divisions ((1) above, line 2):
Casualties $\frac{1}{2} \times 10\% \times 54,561$ ----- 2,728
Nonbattle losses $\frac{1}{2} \times 8\% \times 54,561$ ----- 2,182
One armored division ((1) above, line 3):
Casualties $\frac{1}{2} \times 8\% \times 16,053$ ----- 642
Nonbattle losses $\frac{1}{2} \times 7\% \times 16,053$ ----- 562
Corps nondivisional troops ((1) above, line 4):
Casualties $\frac{1}{2} \times 1.25\% \times 29,300$ ----- 183
Nonbattle losses $\frac{1}{2} \times 3.0\% \times 29,300$ ----- 440
Total losses for 15 days----- 6,737

(c) *Total replacements required.*
Replacements needed now----- 7,914
Losses for 15 day period----- 6,737
Total----- 14,651

e. *Special Estimates for Airborne Operations.*
(1) Personnel losses for airborne forces establishing an airhead may be estimated by applying the applicable daily loss rates from the following table to the *assigned* strengths of the units actually committed in the airhead or en route thereto.

Note. Rates in this table are for planning purposes only. The rates for each airborne operation are different. The rates in this table are useful as a guide or for use in practicing estimate procedures.

	1	2	3	4	5	6	7	8
1		Force en route ^a			Forces in airhead ^{b,c,d}			
2	Day	Para-chute	Assault aircraft	Air-landed	Non-battle	Casualty ^e		
						Para-chute	Assault aircraft	Total division
3	First-----	2%	1.5%	0.5%	0.3%	8%	4%	7.5%
4	Succeeding-----				.3%			2%

^a All losses for forces en route are casualties, proportionate to strength of branch committed, and include landing losses.

^b For all troops, other than airborne divisions and their attachments, committed in the airhead after the initial assault, use the appropriate rates for c above and column 4, table XIV.

^c After the link-up with the land, sea, or air tail, rates and methods given in c or d above for an infantry division are applicable. The rates in this table are applicable only until the airhead is firmly established.

^d Prior to joining the air echelon of the division, the tail of the division sustains losses at sea as given in f below, on overland moves as given in d above for corps and army troops, and at bases as given in paragraph 21 for all troops in the communications zone.

^e Distribution of casualties by branch during operations in the airhead in an airborne division (as percent of division's total casualties)—Infantry 85.6 percent; artillery 6.9 percent; engineers 3.9 percent; and others 3.6 percent. Casualties are distributed by category as follows: Killed 15 percent; wounded 60 percent; captured and missing 25 percent.

- (2) *Example.* Calculate the number of losses which will be sustained by the 102d Airborne Division on D-day and D+1. Base departure time and H-hour are on D-day. Computations for land tail and base echelons are omitted from this example.

	<i>Assigned strength</i>
102d Airborne Division.....	16270
Parachute troops.....	(12214)
Assault aircraft troops.....	(1639)
Land tail and base echelon.....	(2417)
<i>En route:</i>	
(a) Parachute troops:	
$12214 \times 2\%$ (table—col. 2, line 3).....	244
(b) Assault aircraft troops:	
$1639 \times 1.5\%$ (table—col. 3, line 3).....	25
(c) Total losses en route.....	269
<i>Airhead—first day:</i>	
(d) Parachute troops—nonbattle losses:	
$(12214 - 244) \times 0.3\%$ (table—col. 5, line 3).....	36
(e) Assault aircraft troops—nonbattle losses:	
$(1639 - 25) \times 0.3\%$ (table—col. 5, line 3).....	5
(f) Parachute troops—casualties:	
$(12214 - 244) \times 8\%$ (table—col. 6, line 3).....	958
(g) Assault aircraft troops—casualties:	
$(1639 - 25) \times 4\%$ (table—col. 7, line 3).....	65
(h) Total losses in airhead—first day:	
$(36 + 5 + 958 + 65)$	1064
<i>Total D-day losses:</i>	
(i) Losses en route plus losses in airhead:	
$(269 + 1064)$	1333
<i>Airhead—second day—D+1</i>	
(j) Nonbattle losses:	
$(16,270 - 2417 - 1333) \times 0.3\%$ (table—col. 5, line 4)...	38
(k) Casualties:	
$(16,270 - 2417 - 1333) \times 2\%$ (table—col. 8, line 4)...	250
(l) Total losses, D+1:	
$(38 + 250)$	288
(m) Total losses, D-day and D+1:	
$(1333 + 288)$	1621

(3) Work sheet form—personnel loss estimates—airborne operations:

1		2	3	4	5	6	7
1	Day (D -----, D-day, or D+ -----)	D-day			D+1		
2		Rate (percentage)	Strength	Losses	Rate (percentage)	Strength	Losses
3	Forces en route.....	Parachute.....	2.0	12,214	244		
4		Assault aircraft.....	1.5	1,639	25		
5		Airlanded.....					
6	Total—Forces en route.....			209			
7	Forces in airhead.....	Parachute:					
8		Nonbattle.....	0.3	11,970	36	0.3	10,976
9		Casualty.....	8.0	11,970	958	2.0	11,077
10		Total.....			994		
11	Airborne division and attached troops.....	Assault aircraft:					
12		Nonbattle.....	0.3	1,614	5	0.3	1,544
13		Casualty.....	4.0	1,614	65	2.0	1,537
14		Total.....			70		
15	Airlanded divisions and attached troops.....	Nonbattle.....					
16		Casualty.....					
17		Total.....					
18	Airlanded corps and army troops.....	Nonbattle.....					
19		Casualty.....					
20		Total.....					
21	Total—Forces in the airhead.....			1,064			288
22	Total daily losses en route and in airhead.....			1,333			288
23	Losses—Land, sea, or air tail of units in airhead.....	Nonbattle.....					
24		Casualty.....					
25	Losses—Base echelons of units in airhead.....	Nonbattle.....					
26		Total daily losses.....					

f. Special estimates for Amphibious Operations.

- (1) Personnel losses for amphibious forces establishing a beachhead may be estimated by applying the applicable daily loss rates from the following table to the *assigned* strength of units actually committed in the beachhead or en route thereto.

Note. Rates in this table are for planning purposes only. The rates for each amphibious operation are different. The rates in this table are for use as a guide only or in practicing estimate procedure.

	1	2	3	4	5	6	7	8	9
1		Phase I— Forces en route		Phase II—Forces in beachhead					
2		Daily at sea ¹	Landing	First day			Succeeding days ²		
3		Nonbattle and casualty (percentage)	Casualty (percentage)	Nonbattle (percentage)	Casualty (percentage)	Total ³ (percentage)	Nonbattle (percentage)	Casualty (percentage)	Total ³ (percentage)
4	Assault forces ⁴								
5	Divisions and attached troops....	0.5	1.3	0.3	5.3	5.6	0.3	1.5	1.8
6	Corps and army troops.....	0.5	1.0	0.3	3.0	3.3	0.3	1.0	1.3
7	Follow-up forces ⁵								
	Divisions and attached troops....	0.5	0.5	-----	-----	-----	0.3	1.5	1.8
	Corps and army troops.....	0.5	0.5	-----	-----	-----	0.3	1.0	1.3

¹ Rates in this column include both casualties and nonbattle losses in route and are distributed by arm or service in the same proportion to the total losses as the strength of each arm or service is to the strength of the total force being transported.

² After beachhead is secure and forces are building up for the breakout (Phase III), the rates and methods given in c(1) or d(1) above are applicable. The rates in this table are applicable only until the beachhead is firmly established.

³ Losses are distributed as given in c(4) above for nonbattle losses; c(2) or d(4) above for casualties by arm or service; d(2) above for casualties by category (killed, wounded, captured, and missing).

⁴ Assault forces in this table are those units who make their landing in the face of enemy opposition at or near the beaches. For the purpose of computing total division rates, it was assumed that an assault division lands with two regimental combat teams (reinforced) abreast, followed by the reserve combat team and the remainder of the division.

⁵ Follow-up forces in this table include those landing over beaches secured by other friendly forces.

RESTRICTED—Security Information

- (2) *Example.* Calculate the total number of losses which will be sustained during an amphibious operation by I Corps on D—1, D-day, and D+1.

	<i>Assigned Strength</i>
1st Infantry Division.....	17,702
2d Infantry Division.....	17,698
3d Infantry Division.....	17,702
Nondivisional troops, assault echelon.....	12,415
Nondivisional troops, follow-up echelon.....	27,170
Total I Corps.....	92,687

Total I Corps will sail on D—1 at *assigned* strength. On D-day the 1st and 2d Infantry Divisions will assault the beach with 2 regimental combat teams (reinforced) abreast in each division; 3d Infantry Division and nondivisional troops in follow-up echelon will land on D+1.

D—1:

(a) Losses at sea:

1. Assault divisions	
$35,400 \times 0.5\%$ (table—col. 2, line 4).....	177
2. Nondivisional assault troops	
$12,415 \times 0.5\%$ (table—col. 2, line 5).....	62
3. Follow-up division	
$17,702 \times 0.5\%$ (table—col. 2, line 6).....	89
4. Nondivisional follow-up troops	
$27,170 \times 0.5\%$ (table—col. 2, line 1).....	136
5. Total I Corps.....	464

D-day

(b) Assault landing:

1. Assault divisions	
$(35,400 - 177) \times 1.3\%$ (table—col. 3, line 4)....	458
2. Nondivisional assault troops	
$(12,415 - 62) \times 1\%$ (table—col. 3, line 5).....	124

(c) Nonbattle losses:

1. Assault divisions	
$(35,400 - 177 - 458) \times 0.3\%$ (table—col. 4, line 4).....	104

2. Nondivisional assault troops	
(12,415—62—124) × 0.3% (table—col. 4, line 5)	37
(d) Casualties:	
1. Assault divisions	
(35,400—177—458) × 5.3% (table—col. 5, line 4)	1, 843
2. Nondivisional assault troops	
(12,415—62—124) × 3% (table—col. 5, line 5)	367
(e) Losses at sea:	
1. Follow-up division	
(17,702—89) × 0.5% (table—col. 2, line 6)	88
2. Nondivisional follow-up troops	
(27,170—136) × 0.5% (table—col. 2, line 7)	135
(f) Total I Corps D-day losses	
(b) + (c) + (d) + (e)	3, 156
D+1:	
(g) Beachhead losses:	
1. Assault divisions	
(35,400—177—458—104—1,843) × 1.8% (table—col. 9, line 4)	591
2. Nondivisional assault troops	
(12,415—62—124—37—367) × 1.3% (table—col. 9, line 5)	154
(h) Landing losses:	
1. Follow-up division	
(17,702—89—88) × 0.5% (table—col. 3, line 6)	88
2. Nondivisional follow-up troops	
(27,170—136—135) × 0.5% (table—col. 3, line 7)	134
(i) Beachhead losses:	
1. Follow-up division	
(17,702—89—88—88) × 1.8% (table—col. 9, line 6)	314
2. Nondivisional follow-up troops	
(27,170—136—135—134) × 1.3% (table—col. 9, line 7)	348
(j) Total I Corps D+1 losses	
(g) + (h) + (i)	1, 629

(3) Work sheet form—personnel loss estimates—amphibious operations:

	1	2	3	4	5	6	7	8	9	10
1		D-1			D-Day			D+1		
		Rate (per- centage)	Strength	Losses	Rate (per- centage)	Strength	Losses	Rate (per- centage)	Strength	Losses
2	Phase I—Forces at sea:									
3	Assault divisions.....	.5	35,400	177						
4	Nondivisional assault troops.....	.5	12,415	62						
5	Follow-up division.....	.5	17,702	89	0.5	17,613	88			
6	Nondivisional follow-up troops.....	.5	27,170	136	.5	27,034	135			
7	Landing:									
8	Assault divisions.....				1.3	35,223	458			
9	Nondivisional assault troops.....				1.0	12,353	124			
10	Follow-up division.....							0.5	17,525	88
11	Nondivisional follow-up troops.....							.5	26,899	134
12	Total—Phase I.....			464			805			222
13	Phase II—Forces in beachhead:									
14	Assault divisions:									
15	Nonbattle losses.....				.3	34,765	104	1.8	32,818	591
16	Casualties.....				5.3	34,765	1,843			
17	Nondivisional assault troops:									
18	Nonbattle losses.....				.3	12,229	37	1.3	11,825	154
19	Casualties.....				3.0	12,229	367			
20	Follow-up division.....							1.8	17,437	314
21	Nondivisional follow-up troops.....							1.3	26,765	348
22	Total—Phase II.....						2,351			1,407

RESTRICTED

RESTRICTED—Security Information

22. Communications Zone Estimates

In estimating the gross losses for all ground troops in the communications zone, casualties are considered negligible, and nonbattle losses are calculated at 0.5 percent per month. Arm or service distribution of nonbattle losses is determined by applying this nonbattle loss percentage to the strength of each arm or service in the command considered.

23. Theater Estimates

a. Gross Losses.

(1) *First method.* This method is more accurate than (2) below because of frequent changes in organization within a theater.

(a) Determine casualties and nonbattle losses of combat zone troops (par. 21).

1. Divisional.

2. Nondivisional.

(b) Determine nonbattle losses of troops in the communications zone (par. 22).

(c) Add (a) and (b) above.

(2) *Second method.* This method is quicker than (1) above and can be used in a well-established theater, remembering that loss rates are different in various theaters, and within the theater are influenced by different climatic and geographic conditions, enemy resistance, and the nature of current operations.

(a) Apply the following loss rate percentages to the total theater ground strength:

	1	2
1	Type of loss	Percent of total theater strength per month
2	Nonbattle losses.....	4.20
3	Casualties.....	4.08
4	Killed.....	(0.60)
5	Wounded.....	(3.00)
6	Captured and missing.....	(0.48)

RESTRICTED—Security Information**(b) Distribution of casualties by type and by branch:**

Note. This distribution is based on United States Army experience in World War II in all theaters. *Approximately 6½ percent of the losses were officers.* Percentages for Armor given below are composite figures grouping cavalry and armored force percentages. *In actual operations the distribution of casualties by arm or service varies with the composition of the theater, types of operations, etc.*

	1	2	3	4	5	6
1	Branch	Percent of branch's casualties by type				
		Killed	Wounded	Missing	Captured	Total
2	Infantry.....	17.3	71.2	2.8	8.7	100.0
3	Artillery.....	14.3	61.6	3.1	21.0	100.0
	Field.....	(15.7)	(68.0)	(2.7)	(13.6)	(100.0)
	Antiaircraft.....	(10.5)	(43.8)	(4.1)	(41.6)	(100.0)
4	Corps of Engineers.....	18.8	66.9	2.6	11.7	100.0
5	Army Medical Service.....	15.3	66.4	2.9	15.4	100.0
6	Armor.....	19.0	70.8	1.7	8.5	100.0
7	Signal Corps.....	17.2	55.5	4.5	22.8	100.0
8	Quartermaster Corps.....	18.6	42.9	6.6	31.9	100.0
9	Ordnance Corps.....	16.1	43.4	5.7	34.8	100.0
10	Transportation Corps.....	24.1	69.2	5.9	0.8	100.0
11	Chemical Corps.....	22.7	65.3	1.3	10.7	100.0
12	Military Police Corps.....	18.1	71.6	1.3	9.0	100.0
13	Miscellaneous.....	18.8	36.8	13.6	30.8	100.0
14	Total.....	17.2	69.8	2.8	10.2	100.0

	1	2	3	4	5	6
1	Branch	Percent of each type of casualty by branch				
		Killed	Wounded	Missing	Captured	Total
2	Infantry.....	80.9	82.0	79.5	68.5	80.5
3	Artillery.....	5.9	6.3	7.6	14.6	7.1
	Field.....	(4.8)	(5.1)	(4.9)	(6.9)	(5.2)
	Antiaircraft.....	(1.1)	(1.2)	(2.7)	(7.7)	(1.9)
4	Corps of Engineers.....	4.0	3.5	3.3	4.2	3.6
5	Army Medical Service.....	2.6	2.8	2.9	4.4	2.9
6	Armor.....	3.8	3.6	2.1	2.9	3.5
7	Signal Corps.....	0.5	0.4	0.8	1.1	0.5
8	Quartermaster Corps.....	0.6	0.4	1.4	1.8	0.6
9	Ordnance Corps.....	0.4	0.2	0.8	1.4	0.4
10	Transportation Corps.....	0.2	0.1	0.3	0.0	0.1
11	Chemical Corps.....	0.6	0.4	0.2	0.4	0.4
12	Military Police Corps.....	0.2	0.2	0.1	0.1	0.2
13	Miscellaneous.....	0.3	0.1	1.0	0.6	0.2
14	Total.....	100.0	100.0	100.0	100.0	100.0

(c) Distribution of nonbattle losses is in direct proportion to percentage strength of each branch.

b. *Returns to Duty Within the Theater.*

(1) Returns to duty within the theater from hospitals as percent of hospital admissions:

1	1	2	3	4	5
	Days after admission	Within time period		Cumulative at end of period	
		Casualty	Nonbattle	Casualty	Nonbattle
2	0-15.....	15.3	61.0	15.3	61.0
3	15-30.....	15.2	20.7	30.5	81.7
4	30-45.....	11.7	4.5	42.2	86.2
5	45-60.....	8.5	4.4	50.7	90.6
6	60-75.....	5.2	1.2	55.9	91.8
7	75-90.....	3.6	1.2	59.5	93.0
8	90-105.....	2.7	0.2	62.2	93.2
9	105-120.....	2.6	0.2	64.8	93.4

SOURCE: ETO, GFRG History 1944-45.

(2) *Returns to duty from captured and missing status.* Approximately 30 percent of the personnel losses in this category during any given month are recovered for duty within the theater during the same month. Returns to duty from captured and missing status in succeeding months is indeterminable and should be disregarded in making estimates.

(3) *Limited assignment personnel.* Of the personnel who return to duty within the theater from hospitals, the following percentages are limited assignment:

(a) Under 30-day or 60-day evacuation policies:

8 percent of the casualties.

5 percent of the nonbattle losses.

(b) Under 90-day or 120-day evacuation policies:

28.6 percent of the casualties.

5.3 percent of the nonbattle losses.

c. *Net Losses.* Theater net losses for any specified period equal the difference between the theater gross losses for the same period and the personnel who return to duty within the theater during the same period.

d. *Theater Tables.*

(1) The factors in the following tables are *per 1,000 of theater strength*. They were calculated on the basis of—

(a) Returns to duty within the theater from hospitals as given in b(1) above.

RESTRICTED—Security Information

(b) Returns to duty within the theater from captured and missing status as given in *b*(2) above.

(c) Loss rates in each category as follows:

1. Disease and nonbattle injuries—

1 per 1,000 per day

2. Battle injuries (including killed in action (KIA) and wounded in action (WIA))—

1.2 per 1,000 per day

WIA=1.0 per 1,000 per day

$$\frac{\text{KIA}}{\text{WIA}} = \frac{1}{5}$$

KIA=.2 per 1,000 per day

WIA+KIA=1.2 per 1,000 per day

3. Captured and missing—

1 per 1,000 per day

In any theater of operations where returns to duty experience varies from that given in *b*(1) or (2) above or where the ratio of KIA to WIA is not 1:5, these tables would require revision to reflect the different basic data.

(2) *Only the losses which occur during the period starting with the first day of the tables have been considered in the derivation of the factors. The changes in net losses or returns to duty within the theater resulting from losses which occur prior to the date starting with the first day of the tables must be computed separately.*

(3) *Cumulative gross loss factors.*

Note. This table is prepared by multiplying the rates given in paragraph (1) above by the number of days in the period under consideration. For fractional periods of a month, use the proportional part of the monthly factor, thus for 10 days, use 10/30 of the 30-day factor.

	1	2	3	4	5	6	7	8
	Type of loss	30 Days	60 Days	90 Days	120 Days	150 Days	180 Days	360 Days
2	Disease and nonbattle injuries ¹	30	60	90	120	150	180	360
3	Casualties:							
	a. Captured and missing.....	30	60	90	120	150	180	360
	b. Other casualties ²	36	72	108	144	180	216	432

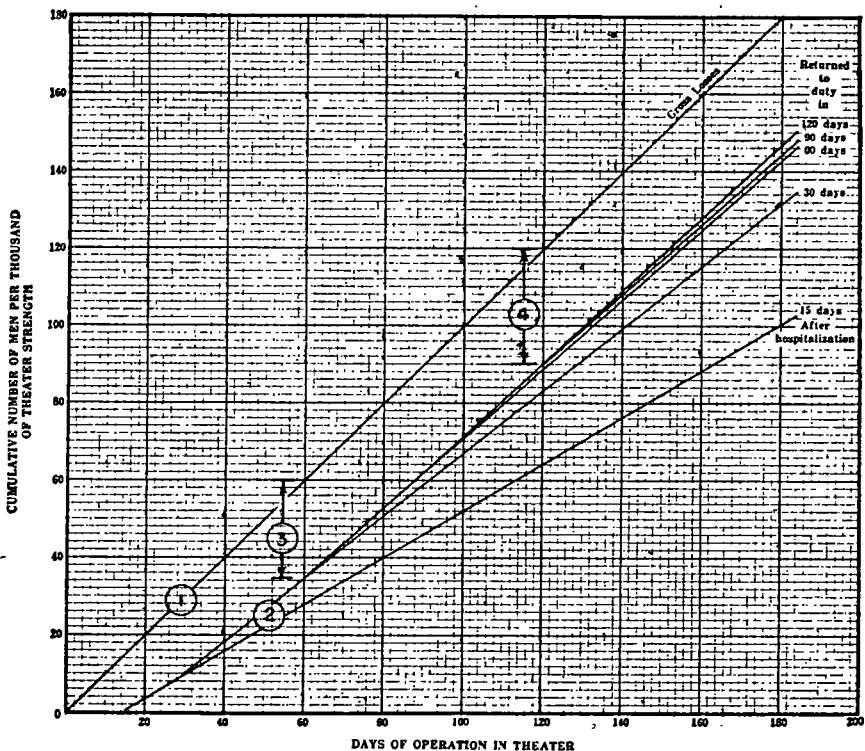
¹ This category includes hospital cases, deaths, and admissions sent to the zone of interior.

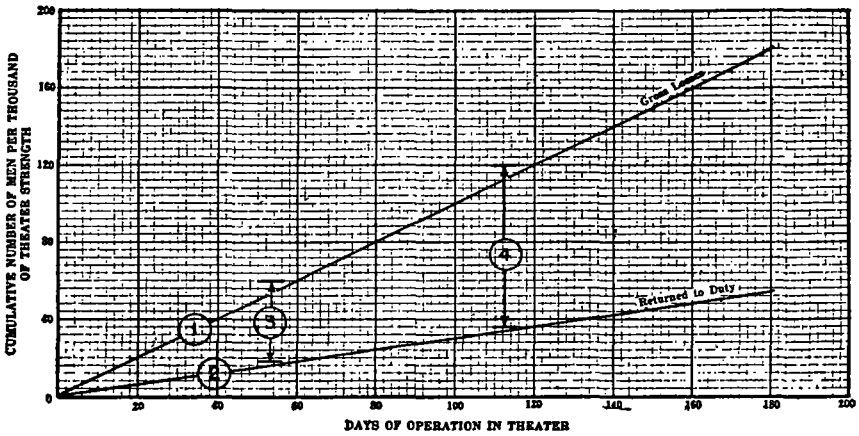
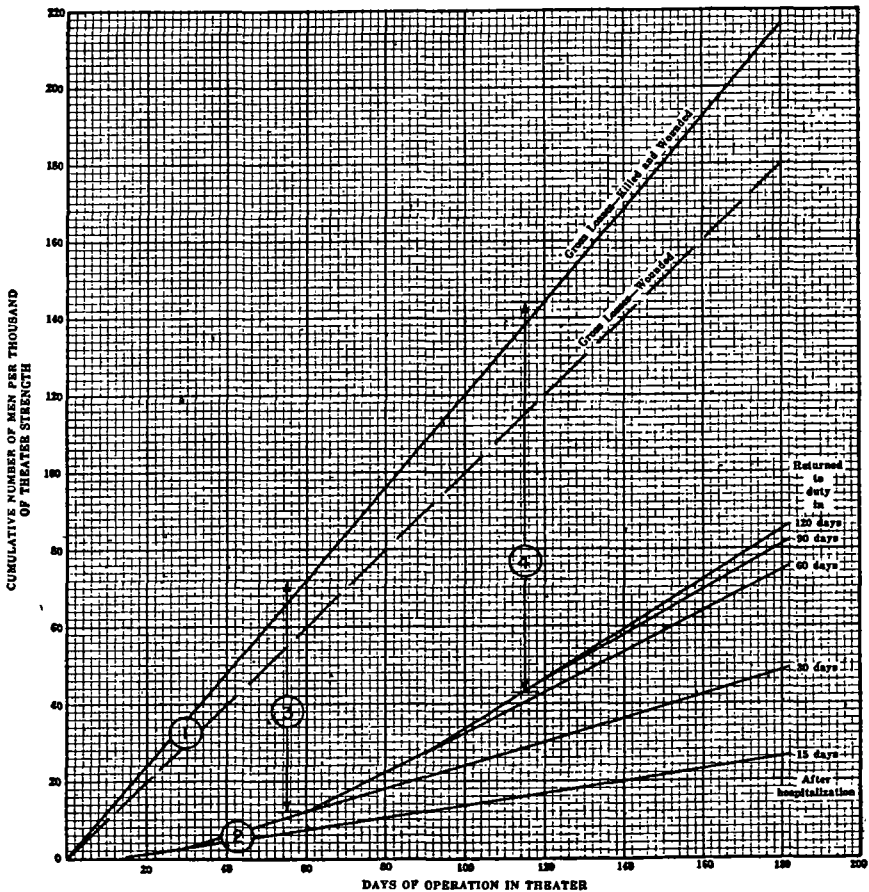
² This category includes hospital cases, killed in action, died in hospital, and admissions sent to the zone of interior.

(4) *Basic graphs for the derivation of factors.*

(a) Cumulative net loss factors contained in the tables of (5) below are derived from the graphs in (d), (e), and (f) below.

- (b) Basic data for construction of the gross loss lines ① on the graphs were taken from (3) above. Basic data for construction of "returns to duty" lines ② were taken from b(1) and (2) above.
- (c) Factors contained in (5) (a), (b), (c), and (d) below were determined by measuring the length or ordinate between the gross line and the returns to duty line corresponding to the evacuation policy considered (30-, 60-, 90-, and 120-day evacuation policy) at 30-day intervals. Thus, measurement ③ is the source of the factors in (5) below, column 3, and measurement ④ is the source of the factors in (5)(c) below, column 5. (Slight variations between those figures taken from the graphs and those given in the table are due to the fact that figures in the table were based on more complete data giving the percent returned to duty within the theater from hospitals at 5-day intervals rather than 15-day intervals as given in b(1) above.)
- (d) *Disease and nonbattle injuries.*



(e) *Casualties—captured and missing.*(f) *Casualties—other than captured and missing.*

(5) *Net loss factors.* (For fractional periods of a month, use the proportional part of the monthly factor; thus for 10 days, use 10/30 of the 30-day factor.)

Cumulative ¹								Monthly ²						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Type of loss	30 days	60 days	90 days	120 days	150 days	180 days	360 days	1-30 days	30-60 days	60-90 days	90-120 days	120-150 days	150-180 days	330-360 days

(a) 120-day evacuation policy:

2	Disease and nonbattle injuries ³ -----	15.2	21.8	25.6	28.7	31.8	34.9	53.5	15.2	6.6	3.8	3.1	3.1	3.1	3.1
3	Casualties:														
	a. Captured and missing-----	21.0	42.0	63.0	84.0	105.0	126.0	252.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
	b. Other casualties ⁴ -----	30.3	56.0	76.8	95.2	113.0	130.8	237.6	30.3	25.7	20.8	18.4	17.8	17.8	17.8

(b) 90-day evacuation policy:

2	Disease and nonbattle injuries ³ -----	15.2	21.8	25.6	28.8	32.0	35.2	54.4	15.2	6.6	3.8	3.2	3.2	3.2	3.2
3	Casualties:														
	a. Captured and missing-----	21.0	42.0	63.0	84.0	105.0	126.0	252.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
	b. Other casualties ⁴ -----	30.3	56.0	76.8	96.0	115.2	134.4	249.6	30.3	25.7	20.8	19.2	19.2	19.2	19.2

(c) 60-day evacuation policy:

2	Disease and nonbattle injuries ³ -----	15.2	21.8	25.6	29.4	33.2	37.0	59.8	15.2	6.6	3.8	3.8	3.8	3.8	3.8
3	Casualties:														
	a. Captured and missing-----	21.0	42.0	63.0	84.0	105.0	126.0	252.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
	b. Other casualties ⁴ -----	30.3	56.2	78.0	99.8	121.6	143.4	274.2	30.3	25.9	21.8	21.8	21.8	21.8	21.8

(d) 30-day evacuation policy:

2	Disease and nonbattle injuries ³ -----	15.2	21.8	28.4	35.0	41.6	48.2	87.8	15.2	6.6	6.6	6.6	6.6	6.6	6.6
3	Casualties:														
	a. Captured and missing-----	21.0	42.0	63.0	84.0	105.0	126.0	252.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
	b. Other casualties ⁴ -----	30.3	58.2	86.1	114.0	141.9	169.8	337.2	30.3	27.9	27.9	27.9	27.9	27.9	27.9

¹ The factors for this section of the table are derived from the graphs in (4) above by subtracting the ordinate of cumulative returns to duty line for each recovery period (30-, 60-, 90-, 120-day evacuation policy) at 30-day intervals from the corresponding ordinate of the cumulative gross line at the same intervals.

² The tabular values for this section of the table are derived from the cumulative net loss factors by subtracting the cumulative net loss factor at the end of each period from the cumulative net loss factor at the end of the next period.

³ This category includes hospital cases, deaths, and admissions sent to the zone of interior.

⁴ This category includes hospital cases, killed in action, died in hospital, and admissions sent to the zone of interior.

RESTRICTED—Security Information

(6) *Returns to duty factors.* (For fractional periods of a month, use the proportional part of the monthly factor; thus for 10 days, use 10/30 of the 30-day factor.)

Cumulative ¹								Monthly ²						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Type of loss	30 days	60 days	90 days	120 days	150 days	180 days	360 days	1-30 days	30-60 days	60-90 days	90-120 days	120-150 days	150-180 days	330-360 days

(a) 120-day evacuation policy:

2	Disease and nonbattle injuries.....	14.8	38.2	64.4	91.3	118.2	145.1	306.5	14.8	23.4	26.2	26.9	26.9	26.9
3	Casualties:													
	a. Captured and missing.....	9.0	18.0	27.0	36.0	45.0	54.0	108.0	9.0	9.0	9.0	9.0	9.0	9.0
	b. Other casualties..	5.7	16.0	31.2	48.8	67.0	85.2	194.4	5.7	10.3	15.2	17.6	18.2	18.2

(b) 90-day evacuation policy:

2	Disease and nonbattle injuries.....	14.8	38.2	64.4	91.2	118.0	144.8	305.6	14.8	23.4	26.2	26.8	26.8	26.8
3	Casualties:													
	a. Captured and missing.....	9.0	18.0	27.0	36.0	45.0	54.0	108.0	9.0	9.0	9.0	9.0	9.0	9.0
	b. Other casualties..	5.7	16.0	31.2	48.0	64.8	81.6	182.4	5.7	10.3	15.2	16.8	16.8	16.8

(c) 60-day evacuation policy:

2	Disease and nonbattle injuries.....	14.8	38.2	64.4	90.6	116.8	143.0	300.2	14.8	23.4	26.2	26.2	26.2	26.2
3	Casualties:													
	a. Captured and missing.....	9.0	18.0	27.0	36.0	45.0	54.0	108.0	9.0	9.0	9.0	9.0	9.0	9.0
	b. Other casualties..	5.7	15.8	30.0	44.2	58.4	72.6	157.8	5.7	10.1	14.2	14.2	14.2	14.2

(d) 30-day evacuation policy:

2	Disease and nonbattle injuries.....	14.8	38.2	61.6	85.9	108.4	131.8	155.2	14.8	23.4	23.4	23.4	23.4	23.4
3	Casualties:													
	a. Captured and missing.....	9.0	18.0	27.0	36.0	45.0	54.0	108.0	9.0	9.0	9.0	9.0	9.0	9.0
	b. Other casualties..	5.7	13.8	21.9	30.0	38.1	46.2	95.0	5.7	8.1	8.1	8.1	8.1	8.1

¹ The cumulative factors for this table are derived by subtracting the cumulative net loss factor from (5) above from the cumulative gross loss factor for the same period from (3) above. They may be derived directly from the graphs in (4) above.

² The monthly factors for this table are derived by subtracting the cumulative returns to duty factor at the end of each period from the cumulative factor at the end of the next period.

(7) Returns to duty within the theater of the losses occurring in any given month.

Note. The factors for this table are derived from the monthly returns to duty factors given in (6) above by subtracting from the monthly factor for each month the monthly factor for the preceding month.

	1	2	3	4	5	6
1	Losses occurring in any given month returned to duty in.....	Same month	1st following month	2d following month	3d following month	4th following month

(a) 120-day evacuation policy:

2	Disease and nonbattle injuries.....	14.8	8.6	2.8	0.7	0
3	Casualties:					
	a. Captured and missing.....	9.0	0	0	0	0
	b. Other casualties.....	5.7	4.6	4.9	2.4	0.6

(b) 90-day evacuation policy:

2	Disease and nonbattle injuries.....	14.8	8.6	2.8	0.6	0
3	Casualties:					
	a. Captured and missing.....	9.0	0	0	0	0
	b. Other casualties.....	5.7	4.6	4.9	1.6	0

(c) 60-day evacuation policy:

2	Disease and nonbattle injuries.....	14.8	8.6	2.8	0	0
3	Casualties:					
	a. Captured and missing.....	9.0	0	0	0	0
	b. Other casualties.....	5.7	4.4	4.1	0	0

(d) 30-day evacuation policy:

2	Disease and nonbattle injuries.....	14.8	8.6	0	0	0
3	Casualties:					
	a. Captured and missing.....	9.0	0	0	0	0
	b. Other casualties.....	5.7	2.4	0	0	0

(8) Theater daily loss rates.

(a) The tables given in (5), (6), and (7) above were computed on the basis of the *assumed* loss rates given in (1) above (1 per 1,000 of strength per day with adjustment for killed in action (KIA)). They must be modified to reflect the actual average daily loss experience of each theater. Thus, in a particular theater, the hospital admission rates for disease and nonbattle injury or for wounds may be higher or lower than 1 per 1,000 per day; and the captured and

RESTRICTED—Security Information

missing rate may be higher or lower than 1 per 1,000 per day.

- (b) The table in (c) below reflects daily loss rates (per 1,000 of theater army strength) which correspond to average experience in all theaters in World War II. This table is provided for planning purposes, and for use in training and other situations where actual theater experience is not available.
- (c) Theater daily loss rates per thousand per day. These daily loss rates correspond to the monthly rates given in a (2) (a) above.

	1	2
1	Type of loss	Rate per 1,000 per day
2	Disease and nonbattle injuries.....	1.4
3	Casualties:	
	a. Captured and missing.....	0.16
	b. Other casualties.....	1.0

(9) *Formula.*

- (a) The formula $R \times T \times S$ is used in computing theater estimates.

1. R= Theater daily loss rate per 1,000 per day ((8) (c) above).
2. T= Factor from appropriate table ((3) above for gross losses, (5) above for net losses, (6) above for returns to duty, (7) above for returns to duty of losses occurring in any given month).
3. S= Theater army strength in thousands.

- (b) The formula is set up and solved for each type of loss separately. Theater totals are obtained by adding the results of the computations for each type of loss.

e. Example. Given a theater army strength of 2,000,000, a 60-day evacuation policy, and theater daily loss rates as shown in (8) (c) above, make the following theater estimates for losses occurring during the next 60 days.

- (1) Gross losses (d(3), (8)(c), and (9) above).

- (a) Cumulative for 60 days.

1. Disease and nonbattle injuries ($1.4 \times 60 \times 2,000$) - 168, 000
2. Casualties:
 - (a) Captured and missing ($0.16 \times 60 \times 2,000$) - 19, 200
 - (b) Other casualties ($1.0 \times 72 \times 2,000$) - 144, 000
3. Total - 331, 200

(b) First 30 days.

1. Disease and nonbattle injuries ($1.4 \times 30 \times 2,000$) 84,000

2. Casualties:

a. Captured and missing ($0.16 \times 30 \times 2,000$) 9,600

b. Other casualties ($1.0 \times 36 \times 2,000$) 72,000

3. Total 165,600

(c) Second 30 days.

(Same as (b) above) 165,600

Note. This computation could have been made by use of table given in a(2)(a) above.

(2) Returns to duty within the theater (d(6), (8), and (9) above).

(a) Cumulative for 60 days.

1. Disease and nonbattle injuries ($1.4 \times 38.2 \times 2,000$) 106,960

2. Casualties:

(a) Captured and missing ($0.16 \times 18 \times 2,000$) 5,760

(b) Other casualties ($1.0 \times 15.8 \times 2,000$) 31,600

3. Total 144,320

(b) First 30 days.

1. Disease and nonbattle injuries ($1.4 \times 14.8 \times 2,000$) 41,440

2. Casualties:

(a) Captured and missing ($0.16 \times 9 \times 2,000$) 2,880

(b) Other casualties ($1.0 \times 5.7 \times 2,000$) 11,400

3. Total 55,720

(c) Second 30 days.

1. Disease and nonbattle injuries ($1.4 \times 23.4 \times 2,000$) 65,520

2. Casualties:

(a) Captured and missing ($0.16 \times 9 \times 2,000$) 2,880

(b) Other casualties ($1.0 \times 10.1 \times 2,000$) 20,200

3. Total 88,600

RESTRICTED—Security Information

(3) Net losses (*c* and *d*(5), (8), and (9) above).

(a) Cumulative for 60 days.

1. Disease and nonbattle injuries ($1.4 \times 21.8 \times 2,000$)	61,040
2. Casualties:	
(a) Captured and missing ($0.16 \times 42 \times 2,000$)	13,440
(b) Other casualties ($1.0 \times 56.2 \times 2,000$)	112,400
3. Total	186,880

(b) First 30 days.

1. Disease and nonbattle injuries ($1.4 \times 15.2 \times 2,000$)	42,560
2. Casualties:	
(a) Captured and missing ($0.16 \times 21 \times 2,000$)	6,720
(b) Other casualties ($1.0 \times 30.3 \times 2,000$)	60,600
3. Total	109,880

(c) Second 30 days.

1. Disease and nonbattle injuries ($1.4 \times 6.6 \times 2,000$)	18,480
2. Casualties:	
(a) Captured and missing ($0.16 \times 21 \times 2,000$)	6,720
(b) Other casualties ($1.0 \times 25.9 \times 2,000$)	51,800
3. Total	77,000

Section III. PRISONER OF WAR CAPTURE RATES**24. General**

In order that the necessary arrangements may be made for the reception, care, and disposition of prisoners of war, it will be necessary to estimate the number of prisoners that probably will be captured over a period of time or for a specific operation. Factors to be considered in preparing such an estimate include the following:

- a. Enemy morale.
- b. Avenues of withdrawal open to the enemy.
- c. Ability of friendly forces to encircle or cut off enemy units.
- d. Type of warfare in which forces are engaged; that is, position warfare, war of movement, etc.
- e. Relative strength of opposing forces.
- f. Intensity and effectiveness of friendly psychological warfare.
- g. Effectiveness of ideological indoctrination of enemy troops.

25. Division and Corps Estimate

a. Equal Force Estimates. When the opposing forces are approximately equal in number, the average number of prisoners expected to be taken can be estimated by using the factors listed below.

<i>Troops</i>	<i>Percentage per month of strength</i>
Armored divisions.....	.8
Infantry divisions.....	1.35
Corps and army nondivisional units.....	negligible

b. Unequal Force Estimates. For estimates by divisions (or task forces) and corps, the following figures are averages, based on experiences of some United States divisions against veteran troops in World War II. In these instances, United States forces were numerically superior by about two to one:

By a division in attack of a defensive position.....	50 per day
By a division in attack of a defensive position preceded by night approach and with complete surprise obtained.....	700 per day
By an armored task force in an encirclement operation.....	1,000 per day
By a division in defense of a position against an unsuccessful attack.....	300 per day
By a corps in an action of 25 days against a determined enemy.	4,680 in 25 days
(Expressed as an average number of prisoners per corps per day).	187 per day
(Expressed as an average number of prisoners per division per day).	47 per day

Note. The percentages and figures shown in *a* and *b* above may be used when estimating prisoners of war expected to be taken by either friendly or the enemy forces.

26. Theater Estimates

For overall estimates on a theater level, the following factor may be used: in a major war, the average daily rate for captured may be estimated at approximately 0.14 per 1,000. Hence, for an enemy force of 1,000,000 the average daily number of prisoners captured may be estimated at 140. As prisoners are not captured at a uniform rate, special preparations must be made for the reception of unusual numbers when theater plans contemplate decisive action, such as cutting routes of withdrawal or driving the enemy against an obstacle.

27. World War II Capture Rates

The following figures were taken from available after-action reports and are presented for information purposes only.

	<i>Average daily capture rate per division</i>	<i>Total number of PW captured</i>
<i>a.</i> 12th Army Group, Europe (36 divisions plus attached troops):		
Period: 1 Nov. 44 to 29 Feb. 45 (120 days)	37	161, 330
Period: 1 Mar. 45 to 30 Apr. 45 (60 days)	307	1, 328, 875
<i>b.</i> Fifth Army, Italy (6 divisions plus attached troops):		
Period: 9 Sep. 43 to 15 Dec. 44 (456 days)	16	44, 473
<i>c.</i> Tenth Army, Okinawa (4 Army and 2 Marine divisions):		
Period: 1 Apr. 45 to 7 Jul. 45 (98 days)	18	10, 864
<i>d.</i> Fourteen armored divisions, Europe (average number of days of combat per division, 133):		
Period: 6 Jun. 44 to 8 May 45 (338 days)	1, 139	832, 824

Section IV. PERSONNEL SERVICES**28. General**

The data presented in paragraphs 29 and 30 are intended for planning purposes only, and do not represent doctrine. The figures have been compiled from the experience of the European Theater of Operations in World War II by averaging the experience of several units over several periods of time. The figures are based on the needs per month of 10,000 troops, except where otherwise noted.

29. Decorations

	<i>Number</i>
Distinguished-Service Cross.....	11
Distinguished-Service Medal (per campaign).....	1
Silver Star.....	107
Legion of Merit (per campaign).....	13
Bronze Star (heroism).....	236
Bronze Star (Meritorious achievement, per campaign).....	160

30. Mail

	<i>Pieces</i>	<i>Weight in pounds</i>	<i>M/tons of shipping space</i>
<i>a. Surface.</i>			
(1) Incoming (to the theater):			
First class	97, 450	2, 250	4. 500
Other	26, 650	49, 754	99. 508
(2) Outgoing:			
First class	54, 973	1, 270	2. 540
Other	1, 436	2, 675	5. 350
<i>b. Air.</i>			
(1) Incoming (to the theater):			
Air mail	171, 000	3, 970	7. 940
V-mail	94, 083	25. 7	. 0514
(2) Outgoing:			
Air mail	120, 066	2, 790	5. 580
V-mail	85, 483	23. 3	. 0466

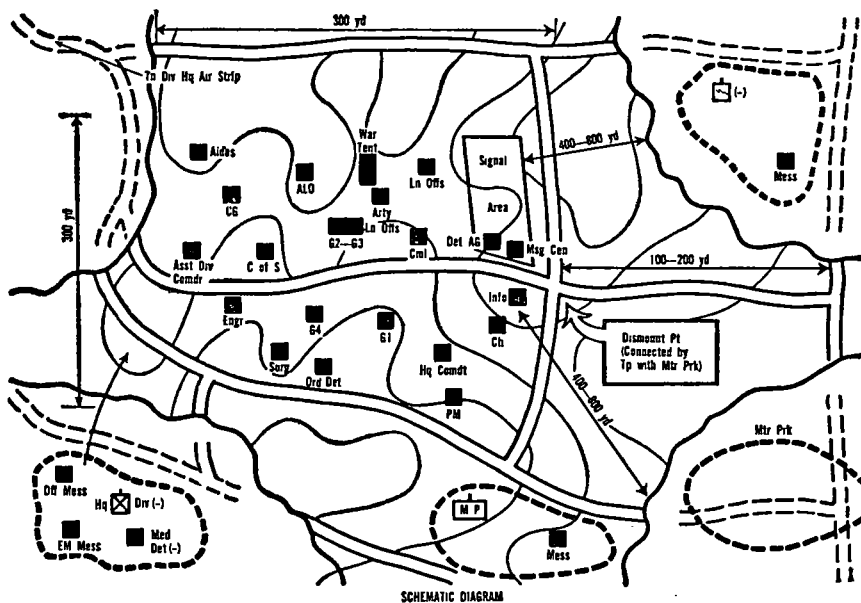
Section V. INTERNAL ARRANGEMENT OF HEADQUARTERS

31. General

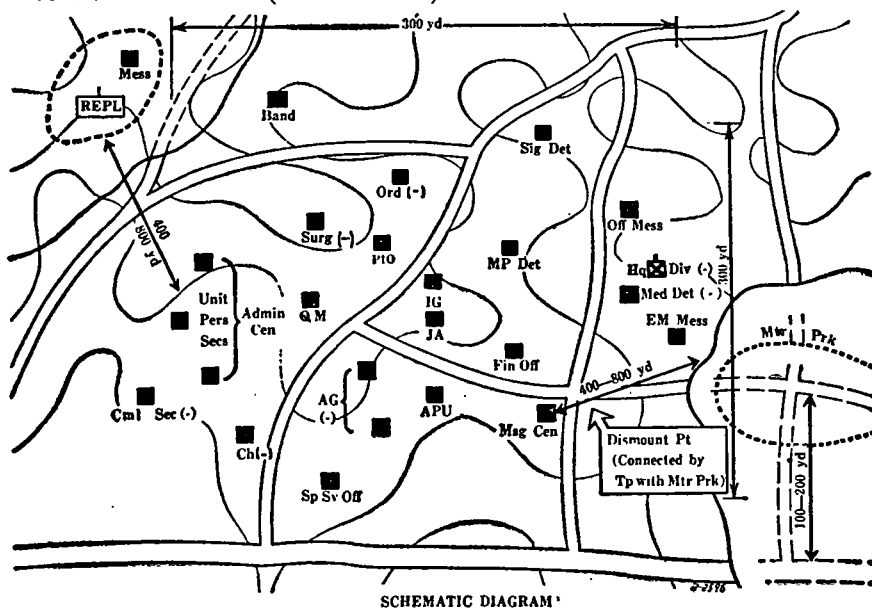
The following diagrams indicate schematic arrangements for army, corps, and division headquarters. The echelons of army and corps headquarters generally are located in buildings. The diagrams which are shown for these headquarters suggest a lay-out to be followed in the event they operate under tentage.

32. Division Headquarters

a. Forward Echelon. (Not to scale.)



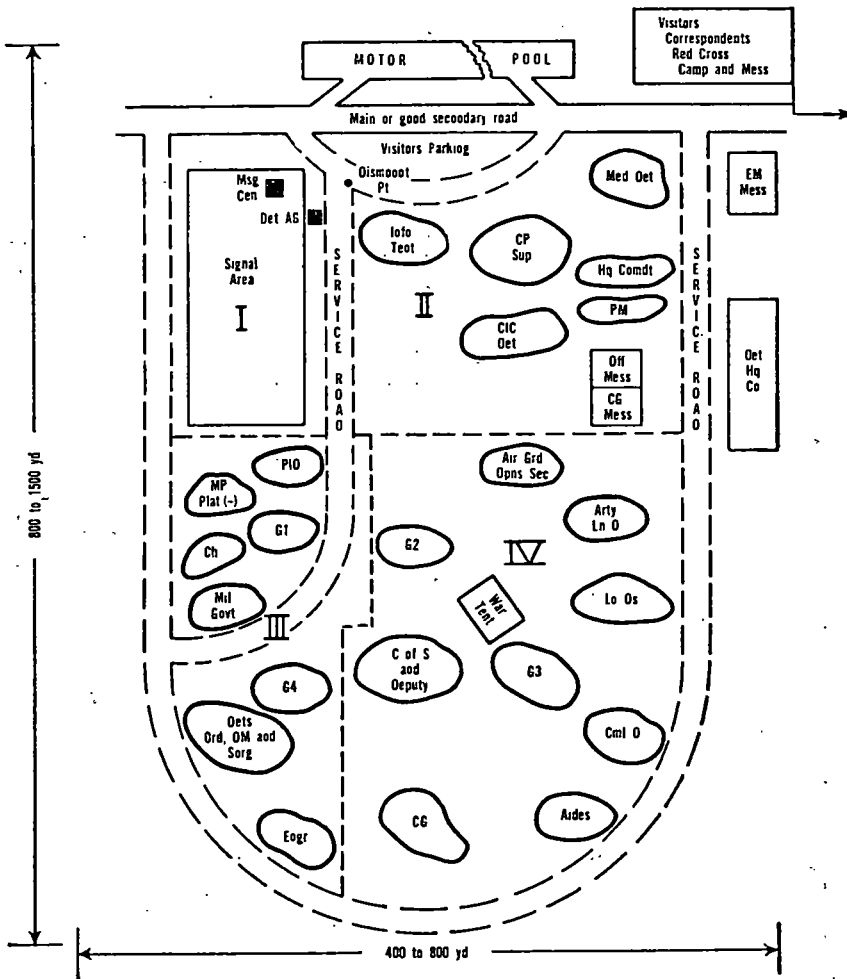
b. Rear Echelon. (Not to scale.)



*This diagram is more applicable to the infantry division. In the armored division, the rear echelon is normally located in the division trains area.

33. Corps Headquarters

a. *Forward Echelon.* (Not to scale.)

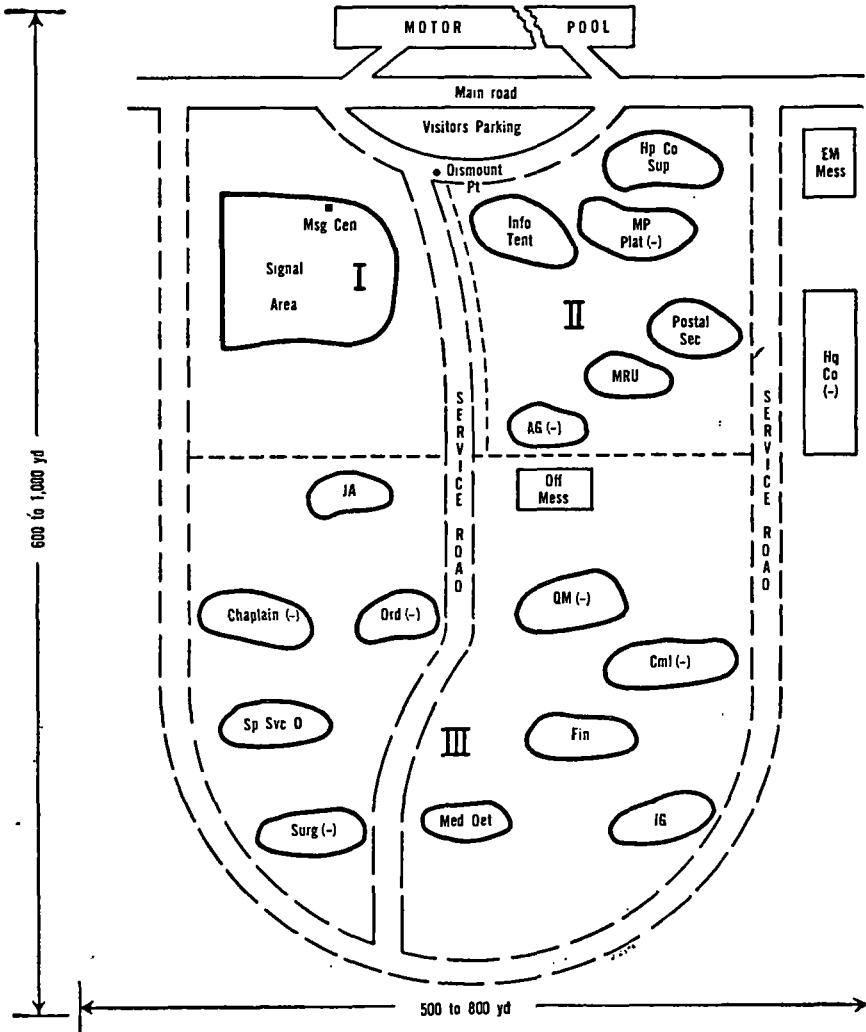


Relative locations of Sections at Corps Command Post.

Notice that the total area occupied is divided generally into four quadrants. Various sections should endeavor to retain their relative positions within their respective quadrants.

RESTRICTED—Security Information

b. Rear Echelon. (Not to scale.)

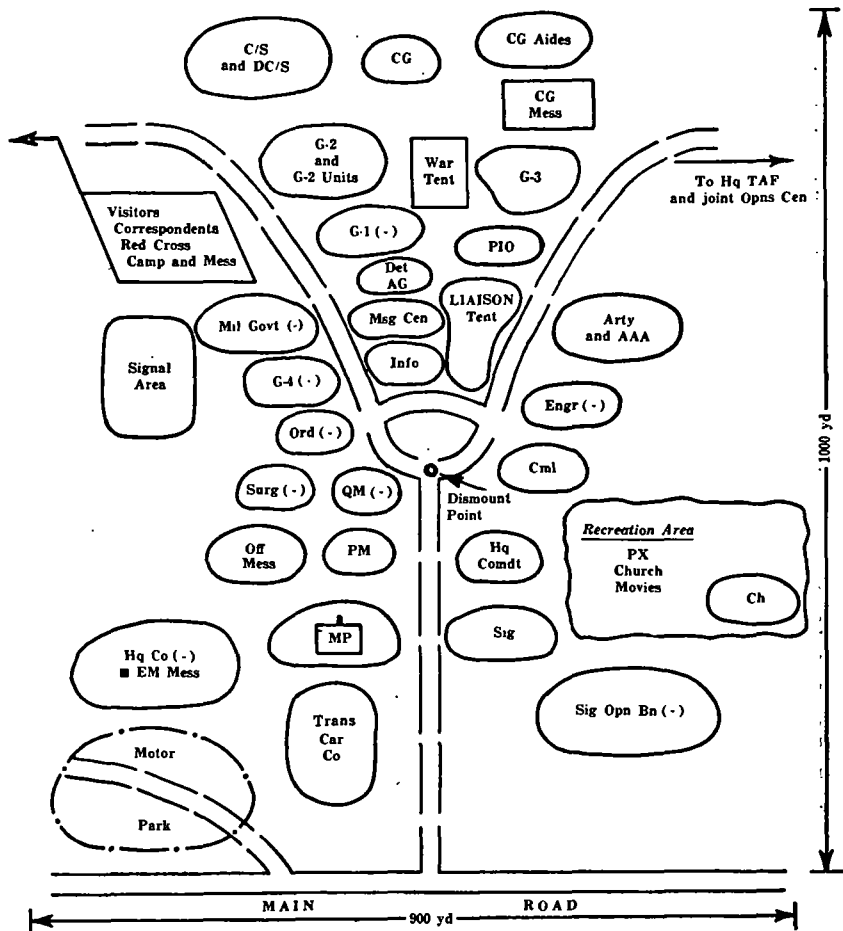


Relative Locations of Sections at Corps Rear Echelon.

Notice that the total area occupied is divided generally into three areas. Various sections should endeavor to retain their relative positions within their respective areas.

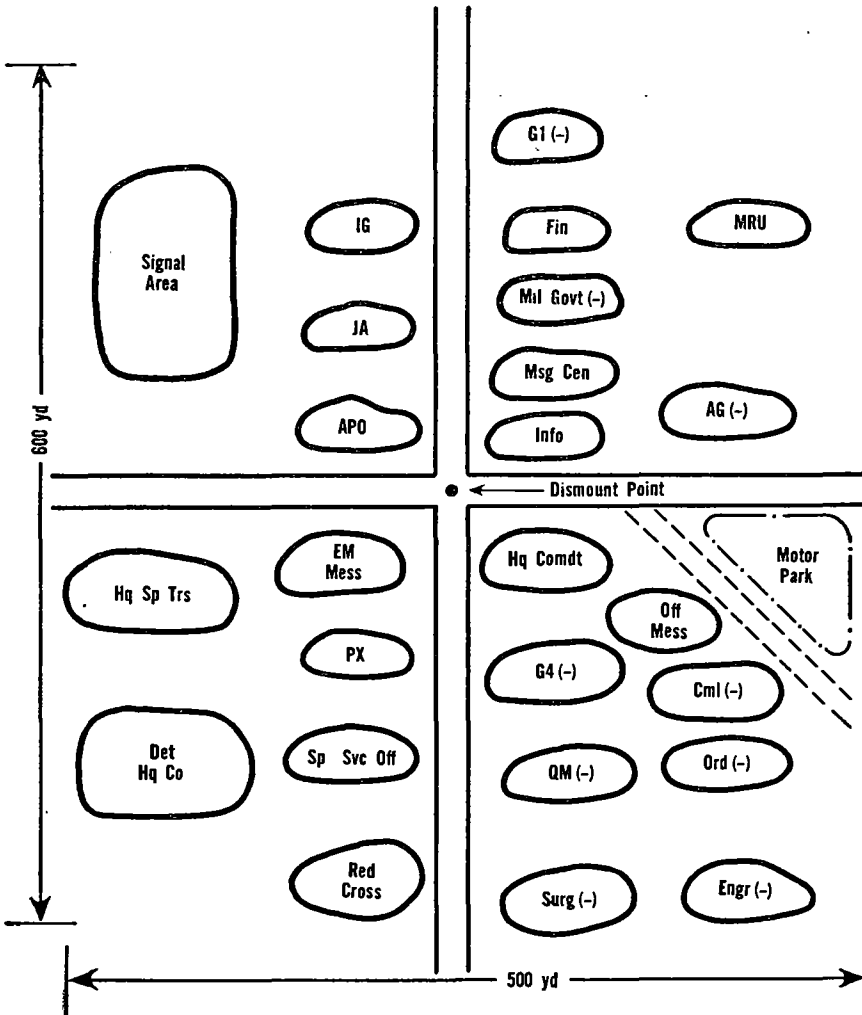
34. Army Headquarters

a. Forward Echelon. (Not to scale.)



RESTRICTED—Security Information

b. *Rear Echelon.* (Not to scale.)



CHAPTER 3
INTELLIGENCE

Section I. GENERAL

35. Intelligence Troop Units

Troop planning data on intelligence units are contained in paragraph 48.

Section II. MAPS

36. Responsibility for Maps and Mapping

Agency		Duties
Zono of Interior	Theater of operations	
Joint Chiefs of Staff (Joint Intelligence Committee).	Theater of Operations, Unified Command (J2).	Coordinate the joint mapping and charting activities within the Department of Defense (Theater of Operations). Determine requirements and prepare plans of joint interest (necessary to support the mission assigned by the Joint Chiefs of Staff) covering the production and distribution of the various series of maps and charts required for military operations and training, and establish project priorities for the separate elements of such plans. Maintain plans and project priorities on a current basis and revise these plans and priorities in keeping with new developments. Provide guidance on operating schedules for the implementation of the operating plans. Assign responsibilities and expand or eliminate activities of the photographic, mapping, and charting agencies of the Department of Defense (Theater of Operations) when such measures are indicated and are not in conflict with existing laws and regulations. The theater of operations executes such specific mapping and charting projects as may be assigned by the Joint Chiefs of Staff. The theater of operations advises the Joint Chiefs of Staff as to map and photo requirements necessary for performance of assigned missions which cannot be met by allotted resources.
General Staff, United States Army (G2).	Theater Army Headquarters (G2).	Responsible for the mapping and charting activities of the Department of the Army (army forces in the theater of operations) and directs and coordinates these activities. Determines Department of the Army (army forces in the theater of operations) requirements and priorities for map and chart coverage pertinent to planning and operations, and takes action to meet these requirements.

RESTRICTED

RESTRICTED—Security Information

Corps of Engineers.	Theater Army Engineer.	The prosecution of surveys and the execution of the photogrammetric processes involved in the production or revision of maps and photomaps required for military purposes. Under supervision of G2, prepares plans and policies pertaining to topographic surveys and maps, including all technical aspects of mapping, together with map reproduction, supply, and distribution. Operation of the Army Map Service. Quantity reproduction of air photos for use throughout the Army (exclusive of reproduction and distribution of photos taken by organic Army aircraft). Coordination with joint, allied, and civilian mapping agencies to avoid duplication of effort and to insure the maximum uniformity of maps reproduced, as directed by G2.
Air Force-----	Theater air force.	The accomplishment of aerial photography. Aerial photography for military mapping will be accomplished in accordance with specifications and priorities prepared by the Corps of Engineers, or theater army engineer, and approved by the G2 General Staff, U. S. A., or theater army G2. Aerial photography for aeronautical charting will be accomplished in accordance with specifications and priorities prepared by the Chief of Staff, Air Force. The preparation of specifications pertaining to aeronautical charts, the procurement, compilation, reproduction, maintenance, supply, and distribution of aeronautical charts and related publications, and the establishment of geodetic control required for aeronautical charting. The development of improved technical processes and equipment used in all aerial photography and of special equipment and methods required by the Air Force for the production of aeronautical charts. In furtherance of the above responsibilities, the Chief of Staff, Air Force, will establish facilities to provide for aeronautical charts covering the world. Aerial photographic work to meet intelligence needs of combat troops.
G2 of divisions or larger units. Unit commander--	G2 of divisions or larger units. Unit commander.	Preparation of plans and policies and supervision of all activities concerning military topographic surveys and maps, including their acquisition, reproduction, and distribution. Advance planning, which is necessary if the mapping situation is to keep ahead of the tactical situation. Good maps will seldom be on hand without special command effort.

37. Military Classification of Maps

a. General Classification.

- (1) *Topographic map.* A topographic map portrays the natural and man-made features of the earth's surface in measurable form, showing both their horizontal and their vertical positions. The vertical positions, or relief, are normally represented by contours. On maps showing relief the elevations are usually referred to a mean sea-level datum-plane. A plastic relief map is a standard topographic map printed on a plastic base and formed to produce the vertical relief, as indicated by the contour lines, at an exaggerated scale.
- (2) *Planimetric map.* A planimetric map presents only the horizontal position for the detail plotted. It is distinguished from a topographic map by the omission of relief in a measurable form.
- (3) *Photomap.* A photomap is a reproduction of an aerial photograph or a mosaic made from a series of aerial photographs, upon which arbitrary grid lines, marginal data, place names, route numbers, contours, important elevations, boundaries, approximate scale, and approximate direction may have been added. Photomaps are not usually contoured.

b. Classification by Scale:

- (1) *Small-scale military maps* have scales of 1:600,000 or smaller.
- (2) *Medium-scale military maps* have scales larger than 1:600,000 and smaller than 1:75,000.
- (3) *Large-scale military maps* have scales of 1:75,000 or larger.

c. Classification by Use or Description.

- (1) A *general map* has a scale smaller than 1:1,000,000. It is used for general planning purposes.
- (2) A *strategic map* has a scale of 1:1,000,000. It is used for planning purposes to include movement, concentration, and supply.
- (3) A *strategic-tactical map* has a scale of 1:250,000. It is used as a detailed planning map, as a graphic to illustrate briefings, as a base for medium scale plastic relief maps, as a road map, and for phases of close air-ground support. When no larger scales are available, it is used as a tactical map and to assist field artillery in fire control.
- (4) A *road map* has a scale of 1:250,000 or smaller. It is used for tactical and administrative troop movements. It gives the location of towns and roads and distinguishes between the various types of roads, road surfaces, and road capacities. Under some conditions a map at the scale of 1:250,000 will

be used interchangeably as a strategic-tactical map and as a road map.

- (5) A *tactical map* has a scale of 1:50,000. It is used for tactical and administrative purposes. A map having a scale of 1:100,000 serves as an alternate. The tactical map is used commonly by all arms and services.
- (6) An *artillery map* has a scale of 1:25,000. It is used for directing artillery fire. A map at the scale of 1:50,000 may serve as an alternate.
- (7) A *photomap*, as defined in a (3) above, has a preferred scale of 1:25,000 and an alternate scale of 1:12,500. It is used for tactical and administrative purposes.
- (8) A *town plan* has a scale of 1:12,500 or larger. It is used to represent the road network of urban areas and to locate principle buildings and other prominent features that are of military importance and which can be plotted at this scale. A distinguishing feature of a *through-way* town plan is that it emphasizes the main thoroughfares leading through an urban area.
- (9) A *situation map* shows the tactical or administrative situation of a unit at a specified time and is of a scale appropriate to the amount of detail required. It may be used for staff study or as an annex to a staff report. When used by intelligence, the situation map is known as the intelligence situation map or the enemy situation map and shows the location and disposition of enemy forces and installations. The situation map can be readily interpreted by intelligence and is used for the dissemination of intelligence information whenever the enemy situation changes rapidly. The situation map is frequently prepared by overprinting special intelligence on a standard map or by printing overlays to be used with standard maps.

d. *Aeronautical Charts* are produced and distributed by the Aeronautical Chart and Information Center, Department of the Air Force. Aeronautical charts are classified according to the use for which they are intended. Principal classifications, uses, and scales follow:

- (1) *Planning charts*. Planning charts are used for the planning of world-wide air routes, controlling strategic air movements, and developing the elements of a major air-transportation system. Planning charts are published at scales of 1:5,000,000 or smaller.

- (2) *Long-range air-navigation charts.* The long-range air-navigation chart is used for celestial navigation and for dead reckoning navigation. It is published at scales of 1:1,000,000 to 1:5,000,000.
- (3) *Standard air-navigation charts.* The standard air-navigation chart is used for pilot orientation in accurate contact flying. It covers land and water areas and shows aids and hazards to navigation. The standard air-navigation chart is frequently called a pilotage chart and is published at scales of 1:250,000 to 1:1,000,000.
- (4) *Approach charts.* An approach chart may be used for the air phase of ground-air support and for contact flying in congested areas. It gives data that pertain to critical obstructions as well as other details that pertain to a desired direction of approach. It may also contain panoramic views and oblique perspectives. The approach chart is published at scales of 1:250,000 to 1:50,000 and larger.
- (5) *Target charts.* The target chart is used to designate a particular air target. This is a large-scale chart which contains schematic information that distinguishes assigned targets in a definite manner or a particular target in a general-target area.

38. Requirements for Military Maps

a. General. To calculate quantities of maps required for an operation, the following must be determined:

- (1) The number of scales at which coverage is to be provided.
Data are in *b* below.
- (2) The number of sheets of each map scale (that is the area coverage required at each scale). Data are in *c* below.
- (3) The number of copies of each sheet required for initial issue. Data are in *d* below.
- (4) The number of copies of each sheet required for replacement issues. Data are in *e* below.
- (5) The number of impressions which must be made for each sheet (that is, the number of colors required). Data are in *f* below.
- (6) Total copies of each scale required for each operation equals—
Sheets $\times$ copies (initial plus replacement).
- (7) Total press impressions of each scale for each operation equals—
Colors $\times$ sheets $\times$ copies (initial plus replacement).

(8) Tonnage of maps and quantities required for large units are shown in *g* below.

b. Map Scales Normally Provided in Bulk at Each Echelon.

	1	2	3	4	5	6	7
	Unit	Theater Hq	Army Gp Hq and Army Gp Trp	Army Hq and Army Trp	Corps Hq and Corps Trp	Armd Div	Inf and Abn Divs
2	General map, small scale: 1:5,000,000.....	x	x	x			
3	Strategic maps, medium scale: 1:1,000,000..... 1:500,000..... 1:250,000.....	x	x	x	x	x	x
4	Tactical maps, large scale: 1:100,000..... 1:50,000..... 1:25,000.....			x	x	x	x
5	Aeronautical charts.....	x	x	x	x	x	x
6	Road maps.....	x	x	x	x	x	x

¹ When the armored division is employed in an essentially infantry division role, it will receive this scale map.

c. Number of Sheets at Each Map Scale (i. e. the area coverage required at each scale).

(1) *Army area coverage.* Number of different map sheets required per army on an average front of 50 miles, assuming a rate of advance of 5 miles per day and a 21-day reserve:

Scale	No. of sheets
1/5,000,000.....	1
1/1,000,000.....	4
1/500,000.....	8
1/250,000.....	8
1/100,000.....	10
1/50,000.....	22
1/25,000 (topographic and photomap).....	100

(2) *Division and smaller unit area coverage* (i. e., number of sheets required to cover an average area of operations):

	1	2	3	4	5	6	7
	Unit	1/1,000,000	1/500,000	1/250,000	1/100,000	1/50,000	1/25,000
2	Div Hq.....	1	5	8	10	12	20
3	Regt Hq.....	1	1	1	8	8	16
4	Bn Hq.....	0	0	1	6	6	10
5	Op Hq.....	0	0	1	4	4	6
6	Off.....	0	0	1	1	2	3
7	Veh.....	0	0	1	0	0	0
8	Wing Hq.....	10	5	12	10	12	0
9	Gp Hq.....	10	5	12	10	12	0
10	Sq Hq.....	6	2	4	0	4	0
11	Airplane.....	1	1	0	0	1	0

- (3) When any series is missing, the number of individual sheets of the next major series is increased to provide equivalent area coverage; for example, in the absence of a 1/100,000 or equivalent scale series, approximately 40 sheets of the 1/50,000 series are required by division headquarters.

d. Copies of Each Sheet Required for Initial Issue.

(1) Guides for estimating quantities.

- (a) General.* General and strategic maps and air charts are issued in small quantities to headquarters only. The basis of issue is the unit headquarters and quantities vary in proportion to the size of the unit. Basic figures are given in table showing headquarters allowances ((g) below).

(b) Tactical maps.

1. *General.* Bases used in computing allowances of tactical maps vary with the type of the unit. The company is the basic unit for computing tactical map requirements. Headquarters and service companies use the same basis as other companies. Allowances for unit headquarters are given in (g) below. In addition, an allowance of 2 copies per organic army aircraft is made.

2. *Infantry and combat engineer units.* Map allowances for infantry and combat engineer units are based on the number of platoons at 2 copies per platoon.

3. *Artillery units.* Allowances for headquarters and service batteries are the same as for infantry units. Allowances for firing batteries are based on the number of sections at one per section plus two per forward observer and liaison officer.

4. *Armored units.* Tactical map allowances for armored units are computed on the same basis as infantry units plus an additional allowance based on the number of tanks, carriages, and armored cars, with armament, at one per two vehicles.

5. *Airborne units.* Allowances for airborne units are the same as for equivalent ground troops. When engaged in airborne operations, allowances will be twice that of equivalent ground troops.

6. *Other units.* Map requirements for other units are based on officer strength at one per officer and one per reconnaissance noncommissioned officer.

- (c) Road maps.* Road maps are issued one per vehicle.

- (d) Air charts.* In addition to the headquarters allowances, air charts are issued on a basis of two per organic army aircraft.

- (e) *Photomaps.* Photomaps are issued as substitutes for tactical maps when the latter are not available. Where necessary as supplements to topographic maps, photomaps are issued in quantities not exceeding those authorized for topographic maps.
- (f) *Hydrographic charts.* Hydrographic charts are issued to units and headquarters as required by the situation and the mission of the unit.
- (g) *Headquarters.* In addition to the guides stated above, the quantities shown in the following table are needed by unit headquarters.

HEADQUARTERS ALLOWANCES

1	2	3	4	5	6
Unit	General (1/5,000,000)	Strategic (1/250,000) to (1/1,000,000)	Tactical (1/25,000) (1/50,000) (1/100,000)	Road maps (Various scales)	Air charts (Various scales)
Army Hq.....	25	75	50	75	50
Corps Hq.....	15	40	75	50	25
Div Hq.....	5	25	55	50	10
Regt Hq.....	1	7	14	15	3
Bn Hq.....	0	3	12	5	0
Co Hq.....	0	1	(?)	1	0

¹ Regiment and battalion needs for service units are 50 percent of those for combat units.

² Fifty percent of the needs for combat companies in (b) above or one copy per company whose needs are based on officer strength.

- (2) *Tables of initial allowances.* Tables of initial allowances of the several classifications of maps for infantry, armored, and airborne divisions are furnished below. These figures are computed according to the basis outlined above, and constitute quantities for initial issue. They are to be considered as a guide only. Allowances for other units can be computed in accordance with the rules in (1) above.

(a) *Infantry division.*

1	2	3	4	5	6	7
Unit	No.	General	Strategic	Tactical	Road	Aero-chart
Hq and Hq Co.....	1	5	26	79	94	26
Regt, Inf.....	3	1	36	280	350	7
Hq and Hq Co.....	(1)	(1)	(8)	(29)	(53)	(7)
Bn, Inf.....	(3)	-----	(8)	(63)	(49)	-----
Hv Tk Co.....	(1)	-----	(1)	(33)	(29)	-----
Hv Mort Co.....	(1)	-----	(1)	(9)	(40)	-----
Serv Co.....	(1)	-----	(1)	(6)	(57)	-----
Med Co.....	(1)	-----	(1)	(14)	(24)	-----
Div Arty.....	1	1	48	494	701	23
Hq and Hq Btry.....	(1)	(1)	(8)	(35)	(66)	(7)
Bn, 105-mm How.....	(3)	-----	(8)	(103)	(130)	(4)
Bn, 155-mm How.....	(1)	-----	(8)	(88)	(100)	(4)
Bn, AAA AW.....	(1)	-----	(8)	(62)	(145)	-----

RESTRICTED—Security Information

1	2	3	4	5	6	7
Unit	No.	General	Strategic	Tactical	Road	Aero-chart
Bn, Hv Tk.....	1	-----	7	92	168	2
Bn, Eng.....	1	-----	8	59	181	-----
Bn, Med.....	1	-----	6	30	81	-----
Bn, Ord.....	1	-----	5	21	104	-----
Co, Sig.....	1	-----	1	13	89	-----
Co, MP.....	1	1	5	96	53	-----
Co, Qm.....	1	-----	1	13	85	-----
Co, Rcn.....	1	-----	1	13	27	-----
Co, Repl.....	1	-----	1	8	5	-----
Total.....	-----	10	217	1,753	2,638	72

(b) Armored division.

1	2	3	4	5	6	7
Unit	No.	General	Strategic	Tactical	Road	Aero-chart
Hq and Hq Co.....	1	5	26	90	85	30
Hq and Hq Co, C Comd.....	3	1	8	25	41	3
Bn, Arm'd Inf.....	4	-----	8	77	153	-----
Bn, M Tk.....	3	-----	8	102	191	-----
Bn, Hv Tk.....	1	-----	7	92	168	-----
Div Arty.....	1	1	48	516	741	23
Hq and Hq Btry.....	(1)	(1)	(8)	(40)	(69)	(7)
Bn, 155-mm How SP.....	(1)	-----	(8)	(97)	(144)	(4)
Bn, 105-mm How SP.....	(3)	-----	(8)	(106)	(128)	(4)
Bn, AAA AW SP.....	(1)	-----	(8)	(61)	(144)	-----
Bn, Rcn.....	1	-----	8	71	156	-----
Bn, Arm'd Eng.....	1	-----	9	59	196	-----
Co, Sig Arm'd.....	1	-----	1	13	93	-----
Co, MP Arm'd.....	1	1	5	96	53	-----
Div, Tns.....	1	1	28	99	458	3
Hq and Hq Co.....	(1)	(1)	(8)	(13)	(50)	(3)
Bn, Ord M, Arm'd.....	(1)	-----	(6)	(21)	(150)	-----
Bn, Med, Arm'd.....	(1)	-----	(7)	(36)	(103)	-----
Bn, QM, Arm'd.....	(1)	-----	(6)	(21)	(150)	-----
Co, Repl.....	(1)	-----	(1)	(8)	(5)	-----
Total.....	-----	11	212	1,725	3,258	65

(c) Airborne division.

1	2	3	4	5	6	7
Unit	No.	General	Strategic	Tactical*	Road	Aero-chart
Hq & Hq Co.....	1	5	26	81	100	16
Regt Inf, Abn.....	3	1	35	240	301	5
Hq & Hq Co, Abn.....	(1)	(1)	(8)	(26)	(50)	(5)
Inf Bn, Abn.....	(3)	-----	(8)	(63)	(49)	-----
Serv Co, Abn.....	(1)	-----	(1)	(6)	(47)	-----
Spt Co, Abn.....	(1)	-----	(1)	(6)	(33)	-----
Med Co, Abn.....	(1)	-----	(1)	(13)	(24)	-----
Div Arty.....	1	1	38	303	463	19
Hq & Hq Btry, Abn.....	(1)	(1)	(8)	(29)	(61)	(7)
Bn, AAA, AW, Abn.....	(1)	-----	(6)	(37)	(60)	-----
Bn, 105-mm How, Abn.....	(3)	-----	(8)	(79)	(114)	(4)
Bn, Engr, Abn.....	1	-----	7	43	125	2
Bn, Med Abn.....	1	-----	6	30	83	-----
Co, Sig Abn.....	1	-----	1	12	70	-----

See footnote at end of table.

1	2	3	4	5	6	7
Unit	No.	General	Strategic	Tactical	Road	Aero-chart
Co, MP Abn.....	1	1	5	96	41	-----
Co, Ord Abn.....	1	-----	1	13	45	-----
Co, QM Abn.....	1	-----	1	11	52	-----
Co, Inf Pabt Maint.....	1	-----	1	7	18	-----
Co, Repl.....	1	-----	1	8	5	-----
Plat, AT Abn.....	1	-----	-----	3	14	-----
Attachments.....	-----	-----	25	306	592	12
Bn, Hv Tks.....	(2)	-----	(7)	(96)	(168)	(4)
Co, Ren.....	(1)	-----	(1)	(13)	(27)	-----
Bn, 155-mm How.....	(1)	-----	(8)	(88)	(100)	(4)
Co, Ord M Maint.....	(1)	-----	(1)	(7)	(58)	-----
Co, QM Fld Serv.....	(1)	-----	(1)	(6)	(71)	-----
Total (without attachments).....	-----	10	192	1,327	1,919	52
(with attachments).....	-----	10	217	1,633	2,511	64

*When participating in airborne operations, initial issue of tactical maps will be twice the number shown in this table.

- (3) *Summary of totals for larger units* (Numbers given are number of copies of each map for initial issue and include a small reserve to be held under unit control).

1	2	3	4	5	6
Units	General 1:5,000,000	Strategic 1:250,000 to 1:1,000,000	Tactical 1:25,000 to 1:100,000	Road various scales	Aero ¹ charts various scales
Army Hq and all army non- divisional troops.....	50	600	1,500	4,500	200
Corps Hq and all corps non- divisional troops.....	40	600	1,500	3,000	100
Inf Div.....	15	250	2,000	3,000	100
Armd Div.....	15	250	2,000	3,500	100
Abn Div (without attachments).....	15	200	² 1,500	2,500	50
(with attachments).....	15	250	2,000	3,000	75

¹ Production and distribution are Air Force responsibilities. Normally, Air Force distribution to troops is in bulk to zone of interior and communications zone map depots; and the engineer makes detailed distribution.

² Is 3,000 for airborne operations.

e. Replacement Requirements. The following percentages refer to quantities an army requires under its control (in addition to the initial issue) in army map depots:

Small scale..... 100% of initial requirements
Medium scale..... 100% of initial requirements
Large scale..... 50% of initial requirements

f. Number of Colors or Press Impressions.

Maximum..... 8
Standard..... 4 (black, brown, blue, green)
Expedient..... 1, 2, 3.

Two- and three-color maps are far superior to one color and should be adopted where time for standard color reproduction is not available.

g. General Factors.

Initial issue: Army 2,700,000 sheets 135 tons
Corps 420,000 sheets 21 tons
Maintenance: Army 120,000 sheets/day 6 tons/day

39. Production of Military Maps

*a. Capabilities of Mapping Units.**(1) Engineer units.*

	1	2	3	4	5	6
1	Units	Maps reproduced	Methods of reproduction	Sheet size (inches)	Remarks	Capabilities
2	Engineer base topographic battalion. One per army group of 3 armies, assigned to theater, located in communications zone.	Maps in large quantities. Maps of permanent utility. Special sketches and drawings. Photomaps. Production and revision of new and existing maps of all types and scales.	Lithography in 1 or more colors. Contact prints (limited numbers only). Duplicator (holograph and similar means).	22 x 29	Battalion is prepared to take over and operate presses of large sizes. Generally assigned long range mapping projects.	New mapping—50 sq mi per day, beginning 21 days after receipt of aerial negatives required. Photomaps—100 sq mi per day beginning 10 days after receipt of aerial negatives. Simultaneous with topographic mapping reduces the latter by 20 sq mi per day. Reproduction—4,000,000 impressions per month on runs of 20,000 copies. Surveying—Six field parties for triangulation, traverse, or level line instrumental survey. Five sq mi per day of plane table survey at a scale of 1/10,000 or smaller.
3	Engineer topographic battalion, army. One per army.	Revision and reproduction of existing maps. Provisional maps and photomaps of unmapped areas for tactical and fire-control use. Sketches and drawing.	Lithography in 1 or more colors. Contact prints (limited numbers). Duplicator (holograph and similar means).	22 x 29	Battalion organized for quantity reproduction to meet the more local reproduction needs of the Army.	New mapping—10 sq mi per day beginning 15 days after receipt of photographs. Photomaps—40 sq mi per day beginning 15 days after receipt of photographs. Reproduction—1,200,000 impressions per month on topographic maps in colors. Surveying—One field survey platoon with four field survey parties capable of triangulation, traverse, level line, and plane table survey.
4	Engineer topographic company corps. One per corps.	Revision and reproduction of existing maps. Provisional and photomaps. Mosaics. Maps of limited areas. Overlays, and sketches.	Lithography in 1 or more colors. Contact prints (very limited numbers only). Duplicator (holograph and similar means).	22 x 29	Multicolor reproduction possible in cases where exactness in matching color plates is not essential and time is available.	New mapping—5 sq mi per day beginning 10 days after receipt of photographs. Photomaps—30 sq mi per day beginning 3 days after receipt of photographs. Reproduction—800,000 impressions per month on topographic maps in colors. Surveying—Two field survey parties capable of instrumental surveys.

RESTRICTED

RESTRICTED—Security Information

5	Engineer aerial photo reproduction company.	Prints of aerial reconnaissance photographs.	Contact printing aerial photos from negatives.	Varies...	Company reproduces, identifies, and prepares for distribution prints of aerial reconnaissance photos. Unit assigned to Joint Aerial Photo Center.	Reproduction, identification and packaging 25,000 diazo-type prints of aerial photos per operational period of four hours.
6	Engineer aviation topographic organization.	Same as engineer topographic company, corps, or engineer base topographic battalion. Revision of existing aeronautical charts. Preparation of target charts.	Same as engineer topographic company, corps, or engineer topographic battalion.	22 x 20	May be organized as Engr Avn Topo Co or Engr Avn Topo Bn to fit the need of the air force to which assigned. Equipment and organization is same as for Engr Topo Co, Corps, or Engr Topo Bn, Army.	Same as for corps topographic company.
7	Division engineers.	Simple sketches, overprints, and overlays.	Duplicator (holograph and similar means).	22 x 33	Lithographic reproduction not possible.	

(2) *Air Force photographic units.*

1	2	3
Unit	Photographs furnished	Remarks
1 Reconnaissance wing (T of opns.)	Specialized photography needed by topographic units for photogrammetry (multiple-lens or wide-angle single-lens type). Vertical and oblique photographs and mosaics for strategic purposes beyond the scope of reconnaissance wings of tactical air commands and tactical air forces.	Wing may include mapping and charting squadrons. Mapping photography ordinarily not suitable for intelligence purposes because of small scale and lack of detail. May contain important information, however, and prints should be made available to military intelligence officers for study.
2 Reconnaissance wings of tactical air commands and tactical air forces (tr.)	Photographs needed for intelligence or combat purposes (single photographs, vertical and oblique, stereopairs, or night photographs).	Reconnaissance missions capable of visual observation and limited vertical and oblique photographs. Photographic missions capable of large quantities of high-altitude, vertical, and oblique photographs and, under extremely urgent circumstances, limited and low-altitude vertical and oblique photographs.

b. Production Data by Map Type ^{1 2 3}

RESTRICTED

	1	2	3	4	5	6	7	8	9	10
1	Kind of map	Scale	Contour interval (feet)	Sheet size (inches)	Size of area	Purpose	Natural features and works of man shown	Originals and limited number of copies prepared by—	Reproduced in quantity by—	Probable time or conditions when available ⁴
2	Vertical aerial photograph.	1:5,000 to 1:100,000 (12 inches = 1 mile to 1 inch = 1 mile).	-----	Varies.....	Varies depending on scale.	Intelligence. Map supplement for study of terrain and other detail. Mosaics, preparation of stereopairs and triplets.	Varies.....	Air Force, civilian agencies.	Lithographic copies by base and army topographic battalions, and corps topographic companies. Contact prints by air photo reproduction companies.	Limited numbers: 3 to 5 hours after photography. Quantities: 48 hours after photography. ⁴
3	Oblique aerial photograph.	Varies.....	-----	Varies.....	Varies, depending on scale.	Intelligence. Map supplement for study of terrain and other detail.	Varies.....	(as above).....	(as above).....	(as above).
4	Tri-metrigon photograph.	Vertical: As taken. Oblique: Varies.	-----	Max. of 22 by 29.	Varies depending on scale.	Map supplement, aeronautical chart production.	Varies.....	(as above).....	(as above).....	(as above).
5	Photo-map.	Approximately 1:5,000, 1:10,000, 1:25,000, 1:50,000.	-----	Max. of 22 by 29.	Varies, depending on scale.	General field uses as map supplement. Limited horizontal control for unobserved artillery fire.	Varies.....	Base and army topographic battalions. Corps topographic companies. Civilian agencies.	Base and army topographic battalions. Corps topographic companies (lithographic copies).	75 to 185 man-hours. 24 to 72 hours after photography, depending on amount of control used. Time includes mosaic and reproduction.

RESTRICTED—Security Information

RESTRICTED

6	Mosaic.....	As taken, enlarged, or reduced.	-----	Maximum of 19 by 20 to 22 by 29 depending on organization printing.	Varies, depending on scale	General field uses as map supplement. Approximate horizontal control for limited unobserved artillery fire.	Varies.....	Army topographic battalions. Corps topographic companies. Civilian agencies. Air Force units up to ten prints, when directed by proper authority.	Army topographic battalions. Corps topographic companies (lithographic copies)	75 to 100 man-hours. 24 to 48 hours after photography. Time includes mosaics and reproduction.
7	Strip mosaic...	As taken, enlarged, or reduced.	-----	Depends on number of photographs.	Varies, depending on scale.	General field uses as map supplement. Approximate horizontal control for limited unobserved artillery fire.	Varies.....	Air Force. Corps topographic companies. Civilian agencies.	Corps topographic companies (lithographic copies).	50 to 75 man-hours or 24 hours after photography. Time includes mosaics and reproduction.
8	Strategic map.	1:1,000,000....	Metric contours at 100, 200, 500, 1,000, 1,500, 2,500, 3,000, 3,500, 4,000 and over thousands thereafter.	26 x 32.....	Standard 4° NS by 6° EW.	Strategy and logistics.	Drainage, relief with gradient tints, populated places, communications.	Army Map Service.	Army Map Service and base reproduction plants.	700 to 2,000 man-hours. Time includes compilation, drafting, reproduction. Reproductions 24 hours.

See footnotes at end of table.

RESTRICTED—Security Information

b. Production Data by Map Type^{1 2 3}—Continued

	1	2	3	4	5	6	7	8	9	10
	Kind of map	Scale	Contour interval (feet)	Sheet size (inches)	Size of area	Purpose	Natural features and works of man shown	Originals and limited number of copies prepared by—	Reproduced in quantity by—	Probable time or conditions when available ⁴
9	Topographic map, contoured, medium scales. ⁵	1 : 250,000 ----	Foreign: 20 or 100 meters. US: 100 or 500 ft. augmented with hill shading.	Max. 24 x 28	Standard 1° NS by 2° EW.	Strategy and logistics. Mechanized and motorized units.	Stream lines, vegetation, and ground forms. Railroads, roads, towns, air fields, etc.	Army Map Service.	Army Map Service and base reproduction plants.	700 to 4,000 man-hours. Time includes compilation, drafting, reproduction. Reproductions 24 hours.
10	Topographic map, contoured. ⁶	1 : 100,000 ----	US: 20 or 100 ft. Foreign: 10, 20, or 40 meters.	Max. 22 x 29	US: 30' x 30'. Foreign: 20' NS x 30', 40', or 60' EW depending upon latitude.	Substitute for 1:50,000 topographic map.	Stream lines, vegetation, and ground forms. Railroads, roads, towns, air fields, etc.	Army Map Service. All military cartographic units.	All military reproduction units.	450 to 5,000 man-hours depending on compilation method. Time includes compilation, drafting, and reproduction. Reproductions 24 to 48 hours.
11	Topographic map, contoured. ⁷	1 : 50,000 ----	US: 5 to 50 ft. Foreign: 10 or 20 meters.	Max. 22 x 29	US: 15' x 15'. Foreign: 10' NS x 15', 20', or 30' EW depending upon latitude. (Certain exceptions.)	General field uses. Tactical and logistical studies by units from corps to regiment.	Drainage systems, water, relief, and forested areas. Railroads, roads, bridges, dams, towns, buildings, etc.	All military cartographic units.	All military reproduction units.	500 to 9,000 man-hours depending upon compilation method. Time includes compilation, drafting and reproduction. Reproductions 24 to 48 hours.

RESTRICTED

RESTRICTED—Security Information

12	Topographic map, contoured. ⁷	1 : 25,000.....	US: 5 to 50 ft. Foreign: 10 or 20 meters.	Max. 22 x 29.	US and Canada: 7½ x 7½'. Foreign: 5' NS x 7½', 10' or 15' EW depending upon latitude. (Certain exceptions.)	General field use. Tactical and logistical studies by units from corps to regiment.	Drainage systems, water, relief, forested areas. Railroads, roads, bridges, dams, populated places, buildings, coastal hydrography, etc.	All military cartographic units.	All military reproduction units.	600-4,500 man-hours depending upon compilation method. Time includes compilation, drafting and reproduction. Reproductions 24 to 48 hours.
13	Coast charts and harbor charts.	Miscellaneous.	-----	Varies.....	Varies, depending on scale.	Coast artillery in harbor defense. All arms in coastal frontier defense.	Hydrography, stream lines, coast line. Harbor, docks, aids to navigation, railroads, roads, towns, air fields, etc.	Coast and Geodetic Survey. U. S. Hydrographic Office. U. S. Lake Survey Office.	Coast and Geodetic Survey. Base reproduction plants. Base and army topographic battalions.	Reproductions: 24 to 48 hours.
14	Transportation maps.	Miscellaneous frequently 1:1,000,000.	Contours seldom shown.	Varies.....	Varies.....	Logistics, maintenance, and operation of communications.	Roads and railroads, drainage systems, water, etc.	Base plants, civilian agencies, Public Roads Administration.	Civilian agencies. Base reproduction plants. Base and army topographic battalions. Corps topographic companies.	Reproductions: 24 hours more.
15	Read maps (civil).	Miscellaneous.	-----	Varies.....	Varies.....	Logistics. Concentration of mechanized units. Maintenance and operation of communications.	Drainage systems, water, etc.	Civilian agencies.	Automobile associations, oil companies, etc.	4 to 12 hours elapsed time, depending upon number of colors. Time for reproduction only.

See footnotes at end of table.

b. Production Data by Map Type^{1 2 3}—Continued

	1	2	3	4	5	6	7	8	9	10
1	Kind of map	Scale	Contour interval (feet)	Sheet size (inches)	Size of area	Purpose	Natural features and works of man shown	Originals and limited number of copies prepared by—	Reproduced in quantity by—	Probable time or conditions when available ⁴
16	Aeronautical charts pilotage.	1:1,000,000 and 1:250,000.	Elevations shown by color or gradients.	Varies.....	Varies.....	Aerial navigation and as strategic map substitute.	Streamlines and ground forms. Railroads, roads, towns, air fields, and aids to aerial navigation.	Coast and Geodetic Survey. U. S. Hydrographic Office. Corps of Engineers.	Coast and Geodetic Survey. U. S. Hydrographic Office. Base reproduction plants.	Reproductions: 24 to 48 hours.
17	Aeronautical charts, approach.	1:250,000 to 1:50,000 or larger.	-----	14 by 17 or larger.	Varies.....	Used by air in approaching objectives.	Prominent features, roads, etc.	Air Force.....	Air Force.....	24 hours and up.
18	Aeronautical charts, target.	1:75,000 (varies).	-----	14 by 17 or larger.	Varies.....	Contains information necessary to distinguish assigned air targets.	Prominent features, roads, etc.	Air Force.....	Air Force.....	24 hours and up.

¹ The information contained in this table is in accordance with present military standards. Appropriate modifications are necessary for emergency war time reproduction of foreign maps and of United States maps made by civilian agencies.

² Maps of foreign theaters, available for initial operations, will vary from direct one color reproduction of foreign maps without translation of names and symbols, to multicolor maps compiled in accordance with United States standards. Any of the maps listed herein may be issued in a hasty and less accurate form, in which case they are called provisional maps.

³ In the United States, topographic maps also are published by civilian agencies at a variety of scales including: 1:24,000, 1:31,680, 1:62,500, 1:63,360, and 1:125,000. Various additional scales also may be encountered in foreign maps.

⁴ Size of run and number of colors will govern reproduction time. Estimated time is given in man-hours for 1,000-sheet runs unless otherwise indicated. Generally,

actual number of days for peacetime mapping can be determined by dividing man-hours by 40 (average 5 men working simultaneously on an 8-hour day); elapsed time during wartime will be reduced depending upon number of men working simultaneously and number of hours worked by each per day. Time estimates are predicted upon adequately organized, equipped, and trained mapping (Air Force and Engineer) and reproduction (Engineer) troops. Under less favorable conditions more delay must be expected.

⁵ Under most favorable conditions, a single wet-print can be dropped within 30 minutes after photography, when the rapid type of photography is used, in which case no negative is available.

⁶ Overprinted with 10,000 meter Universal Transverse Mercator Grid.

⁷ Overprinted with 1,000 meter Universal Transverse Mercator Grid.

RESTRICTED

RESTRICTED—Security Information

c. General Production Factors.

- (1) In planning an operation, map requirements are estimated well in advance of the operation and are requisitioned from the zone of interior. Theater, army, and corps produce maps to supplement planned requirements. As a general rule, supplemental maps of a scale of 1/100,000 and larger are reproduced by army and corps; maps of 1/250,000 and smaller scale, by the communications zone.
- (2) Press size—22½ in. x 30 in.
- (3) Impressions per press-day—30,000 (bulk work only).
- (4) Average map paper consumption per
army----- 5,000 reams/month
167 reams/day
- (5) Maximum map paper consumption per
army----- 500 reams/day
- (6) Photomap paper consumption per army_ 1,000 reams/month

d. Production Capacity Required.

- (1) Army—3,000,000 impressions per month.
- (2) *Communications zone.*
 - (a) Five million impressions per month for each three armies supported.
 - (b) A new mapping capacity of 100 square miles per day.

40. Storage of Maps

a. Weights and Cubages.

(1) *Paper.*

Sheet size (inches)	Line map—High wet strength* (pounds per 1,000 sheets)	Photomap—Coated two sides (pounds per 1,000 sheets)
20 x 22½-----	55.6-----	66.4
22 x 29-----	81.9-----	94.1
24 x 34-----	104.7-----	120.4
26 x 32-----	106.8-----	122.7
28 x 50-----	179.6-----	206.5
Sheet thickness-----	.0040-in-----	.0035-in
Thickness, 1,000 sheets----	4-in-----	3.5-in

*For United States hydrographic charts, use twice weights shown for high wet strength paper.

(2) *Crated or bundled maps.*

Packaging	Weight	Cubage
Bundle, 500 map sheets-----	60 lb	2 cu ft
Crate, 1,000 map sheets-----	150 lb	5 cu ft

b. Floor Space.

- (1) Base map depot for each group of three armies—45,000 square feet, increasing at the rate of 7,500 square feet per month of operations.
- (2) Base map depot for each air force—10,000 square feet, increasing at the rate of 2,000 square feet per month of operations.
- (3) Advance map depots serving each army—10,000 square feet.

41. Map Distribution

a. General. Although maps are an item of Class IV supply, there are several features which establish them as a peculiar supply item which must be handled separately through a system set up exclusively for this purpose. The special features which place map distribution in a class by itself are—

- (1) *Security.* Bulk production, movement and issue of maps are accurate indexes of the scope of forthcoming operations.
- (2) *Transitory application.* Changes in culture as revealed by the constantly expanding sources of information may quickly render maps obsolete and may require several improved editions or issues in the course of a single operation.
- (3) *Relation to the operation.* Unlike other supply items, maps have a direct relation to the exact place in which the operation is to occur.
- (4) *Phasing of supply.* In general, bulk stocks of maps cannot be prepared, and distribution planned, far in advance. However, collection of source material for map production must be constant and world-wide. Production must be phased to insure the application of the last bit of terrain information which can be safely used. Issue can be made only after an exact assignment of missions has been made.

b. Responsibility.

- (1) Map requirements for a command are computed by the engineer under the supervision of the G2 who coordinates the requirements of subordinate commands. Requisitions are prepared and submitted through engineer channels in sufficient time to permit the reproduction and shipment of the maps required.
- (2) Engineers of divisions and larger units are charged with the distribution of military maps in the field, except such confidential or secret maps as may require special distribution. They obtain maps not printed by their echelons from the engineers of the next higher units.

c. Depots.

(1) *Peacetime and zone of interior.* Distribution is made by requisitions drawn on the Army Map Service through channels as prescribed by the Chief of Engineers.

(2) *Wartime theater of operations.*

- (a) Base and advance depots are located in the communications zone, with the advance depot near the forward limit of the communications zone. Base map depots receive and store bulk stocks from the Army Map Service and base reproduction plants; break down and distribute bulk stocks to advance depots; distribute to base depot units; and operate a retail map store for base headquarters. Advance map depots receive and store bulk stocks from base map depots; break down and distribute bulk stocks to army map depots; and operate a retail map store for the headquarters of units located in the area.
- (b) The army map depot is located in the army service area, usually near army rear headquarters. In a fast moving operation it may be necessary to operate two map depots which leapfrog over each other as the army headquarters moves forward. The army map depot has functions parallel to those of the base map depot. The depot is operated by the map storage and distribution section of the army topographic battalion.
- (c) The corps map depot is located in the corps service area and has the same functions as the base map depot, but on a smaller scale. It is operated by a section of the corps topographic company.
- (d) The division map store is located at division headquarters and is operated by the division engineer staff section. The only functions performed are to receive bulk stocks, distribute maps to divisional and attached units, and store the division reserve map stocks.

d. Labor Estimates. Map depot labor may be estimated at 20 man-hours per 10,000 maps issued, including rolling, coding, packing, and collating unit packages.

42. Determining Map Requirements

a. Preliminary Planning. Army G2 confers with G3 to determine the types and scales of maps to be used by subordinate units and army headquarters. An operational map is selected for use by army and corps headquarters so that all orders, overlays, and references will be based on the same map. The army engineer attends these staff conferences to advise on the availability of maps in army and base map depots, capacity of reproduction facilities, and types and scales which can be most readily reproduced. G3 outlines the area for which map coverage is desired. This area will be well in advance of the present front lines of the army because of the time required for procurement, production, reproduction, and distribution of maps. In addition, maps of the future area of operations are required early for planning purposes. G3 also outlines tentative future dispositions, direction of attack, and boundaries of army and subordinate units. This tentative information will be used by the engineer in determining map requirements for the army.

b. Method. With the information furnished by G3 and the data in paragraphs 35–40, or similar data developed through experience, the army engineer calculates map requirements for all units of the army and army headquarters. The procedure is as follows:

- (1) Lay out the projected army area for which coverage is desired on the pertinent index map.
- (2) In the army area outlined on the index map, lay out the tentative corps and division boundaries. Project these boundaries to cover the entire area for which map coverage is desired. While these projected boundaries will change during the campaign, divisions and corps of the army will operate in the area. Therefore calculations based on one pattern of operations are valid for map procurement purposes.
- (3) List the units requiring each map sheet. Note that divisions in reserve will require map sheets of the entire front in which they may be employed.
- (4) List the identifying numbers of the map sheets required to cover the area included within the army boundaries, including sheets bordering closely on the boundaries.
- (5) Determine the number of copies of each sheet required at each echelon, using factors in paragraph 38*d*(3), or developed experience factors.

- (6) List the total number of copies of each map sheet required. These are planning figures for *initial issue*. *Replacement requirements* are determined by multiplying the numbers of each sheet required for initial issue by the proper percentage factor in paragraph 38e. The sum of the initial requirement plus the replacement requirement for each sheet represents the total number of copies of each sheet that must be procured. These are procured from higher echelon or produced by topographic units within the army.

43. Terrain Models

a. Classification.

Type of model	Horizontal scale	Vertical exaggeration
Strategic planning.....	1:250,000 and smaller.....	4:1 up to 10:1
Tactical planning.....	1:100,000 to 1:25,000.....	2:1 up to 4:1
Assault landing.....	1:25,000 to 1:5,000.....	1:1 up to 2:1
Airborne landing.....	1:5,000 to 1:500.....	1:1 up to 2:1
Assault.....	1:10,000 and larger.....	1:1 up to 2:1
Aerial target.....	1:5,000 to 1:2,500.....	1:1 up to 2:1

b. *Quantity requirements.* The determination of quantity requirements and the issuance of terrain models is a matter for staff control. Terrain models and plastic relief maps are seldom stocked outside base plants. The Army Map Service is currently the only base plant for terrain models and does stock plastic relief maps at scales of 1:250,000, 1:1,000,000, and certain other miscellaneous scales. These maps can be requisitioned through proper engineer channels. Quantity requirements depend solely upon the estimate of the military situation. The necessary provisions to meet those requirements are determined by staff studies of combat needs; the resultant production and supply of models are determined by command decision. The commander, having model-making units under his control, directs that a G2 intelligence study and an engineer technical appraisal be performed to determine what models are to be constructed. When assigned model-making capacities are inadequate, the commander submits appropriate requests to higher headquarters. Upon completion of construction, the model is issued immediately and directly to the headquarters or command for which it was produced.

c. Production Rates.

1	2	3	4		5	6	7	8						
Unit	Type of model	Per- cent of pro- duc- tion capa- city	Man-hours		Num- ber of quads per month	Output of orig- inal in sq ft per 8- hr day	Output of copies in sq ft per 8-hr day	Man- hours per square foot of origi- nal						
			Class	Per day										
Theater HQ, 3 pla- toons, 6 officers, 120 enlisted men.	RUBBER CASTINGS													
	Assault (hand painting re- quired).	100	Const.....	472	a9	5.2	57.5	165						
			Control.....	104										
			Repro.....	40										
			Finish.....	288										
	Total.....	100	-----	904	9	5.2	57.5	165						
CONUS HQ, 12 offi- cers, 238 enlisted men.	VINYL-PLASTIC EMBOSSED MODELS													
	{ Assault.....	25	339	b24	4.2	112	80							
								Tactical.....	45	610	b24	4.3	112	140
								Strategic.....	30	408	b17	2.9	74	140
		Total.....	100	1,357	65	11.4	298							
Theater HQ, 6 officers, 120 enlisted men	{ Assault.....	50	260	b18	3.3	112	80							
								Tactical.....	40	208	b8	1.5	74	140
								Strategic.....	10	52	b2	.4	37	140
		Total.....	100	520	23	5.2	223							
	T/O & E 5-500 Relief Map-Making Team, 1 officer, 18 enlisted	{ Assault.....	50	52	b3	0.65	37	80						
Strategic.....									50	52	b2	.37	37	140
									Total.....	100	104	5	1.02	74

a 3 by 5 ft.

b 22 by 29 in.

Section III. TIME, TIDE, AND LIGHT

44. Designating Time and Date

a. Time. Time is expressed in a group of four digits ranging from 0000 to 2400. The first two digits are the hours after midnight, and the remaining two digits indicate the minutes past the hour. Where the hour can be expressed by a single digit, it is preceded by zero (0), for example, 0625 for 6:25 AM.

b. Date.

- (1) The day, month, and year are expressed in that order, except when it is necessary to specify a 6-digit time group and then the following order is used: the first two digits indicate the day of the month, the next two digits indicate the hour, and the last two digits indicate minutes past the hour.

Example: 070625 Dec 47 (6:25 AM 7 Dec 47).

The day is expressed by numerals; the month is either spelled out or abbreviated. Abbreviations, if used, consist of the first three letters of the word. The year is expressed by four digits or by the last two digits.

Example: 14 January 1946; 14 Jan 1946; 14 Jan 46.

- (2) When it is desired to keep the date secret, dates may be expressed by a letter such as D plus or minus a numeral.

c. Greenwich Civil Time. Communications between headquarters in different time zones are usually dated, and references to dates and times are usually made, in Greenwich civil time. The standard time at Greenwich, England, is accepted as the basis for measuring time throughout the world. Local civil time can be changed to Greenwich civil time by adding or subtracting the appropriate number of hours as indicated in the time zone chart, *e* below. Greenwich civil time can be changed to local civil time by reversing the signs of the time zone chart. Appropriate adjustment must be made for daylight saving time and war time.

d. Time Suffixes. Time groups expressing Greenwich civil time are designated by the letter suffix Z immediately following the last digit of the group. For example, 190225Z indicates 2:25 A. M. on the nineteenth of the current month, Greenwich civil time. Any other suffix used after a four digit time group (corresponding to the Z of Greenwich civil time) indicates the zone in which the local civil time is expressed. *It does not designate location on the earth's surface.* The proper suffix can be determined from the time zone chart and the time conversion table in *e* and *f* below. For example, Kansas City is located in the sixth time zone west of Greenwich. If that city keeps local civil time, the time group suffix will be S.



f. Time Zone Conversion Table.

TIME ZONE	HOURS OF DAY IN LOCAL CIVIL TIME																																																																						
	PREVIOUS DAY																								SAME DAY																								NEXT DAY																						
0 (Z)	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11																							
-1 (A)	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12																							
-2 (B)	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13																							
-3 (C)	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14																							
-4 (D)	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15																							
-5 (E)	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16																							
-6 (F)	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17																							
-7 (G)	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18																							
-8 (H)	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19																							
-9 (I)	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20																							
-10 (K)	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22																						
-11 (L)	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22																							
-12 (M)	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23																							
+1 (N)	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10																							
+2 (O)	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09																							
+3 (P)	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08																							
+4 (Q)	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07																							
+5 (R)	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06																							
+6 (S)	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05																							
+7 (T)	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04																							
+8 (U)	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03																							
+9 (V)	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02																							
+10 (W)	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01																							
+11 (X)	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00																							
+12 (Y)	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23																							
	PREVIOUS DAY																								SAME DAY																																														

RESTRICTED

RESTRICTED—Security Information

45. Expression of Natural Phenomena.

a. Staff officers avoid the use of such indefinite terms as *first light*, *last light*, *daybreak*, *daylight*, *darkness*, *dusk*, and *dawn*. Terms of a definite nature, as *sunrise*, *sunset*, and *beginning* or *ending of evening* or *morning nautical* or *civil twilights* are permissible. However, expressions of these times to lower units must be in clock time.

b. For purposes of military planning and to facilitate staff work in expressing natural phenomena in time, theater commanders prepare and publish for the theater as a whole or for major geographic portions thereof, daily time, sunrise, sunset, twilight, moon, and tide tables, and specify the number of hours the local time differs from Greenwich civil time.

46. Tides, Sunlight, and Moonlight

a. *General.* A sample of the type of chart which should be prepared and issued for each major operation or operational area is shown in *j* below. These charts are prepared by the Joint Intelligence Study Publishing Board and appear in "JANIS." They are available through Army channels for many portions of the world.

b. *Area Covered.* The astronomical data are for sea level and will not vary more than 5 minutes for each degree of the difference in longitude from the standard meridian.

c. *Time Used.* The times on the diagram are for the time meridian indicated in the heading. When another time meridian is to be used in the field, it will be found convenient to change the figures representing hours on the left of the large diagram to conform to the new time. If the time meridian to be used is east of the one shown on the diagram, increase the figure by 1 hour for each 15°; if west, decrease the figures.

d. *Dates.* In the upper diagram, each day from midnight to midnight is represented by a space between 2 lines. In the lower diagram the days are represented by vertical lines covering the period from noon of one day to noon of the next. The dates at the bottom of the diagram differ from those at the top because the date changes in passing through midnight.

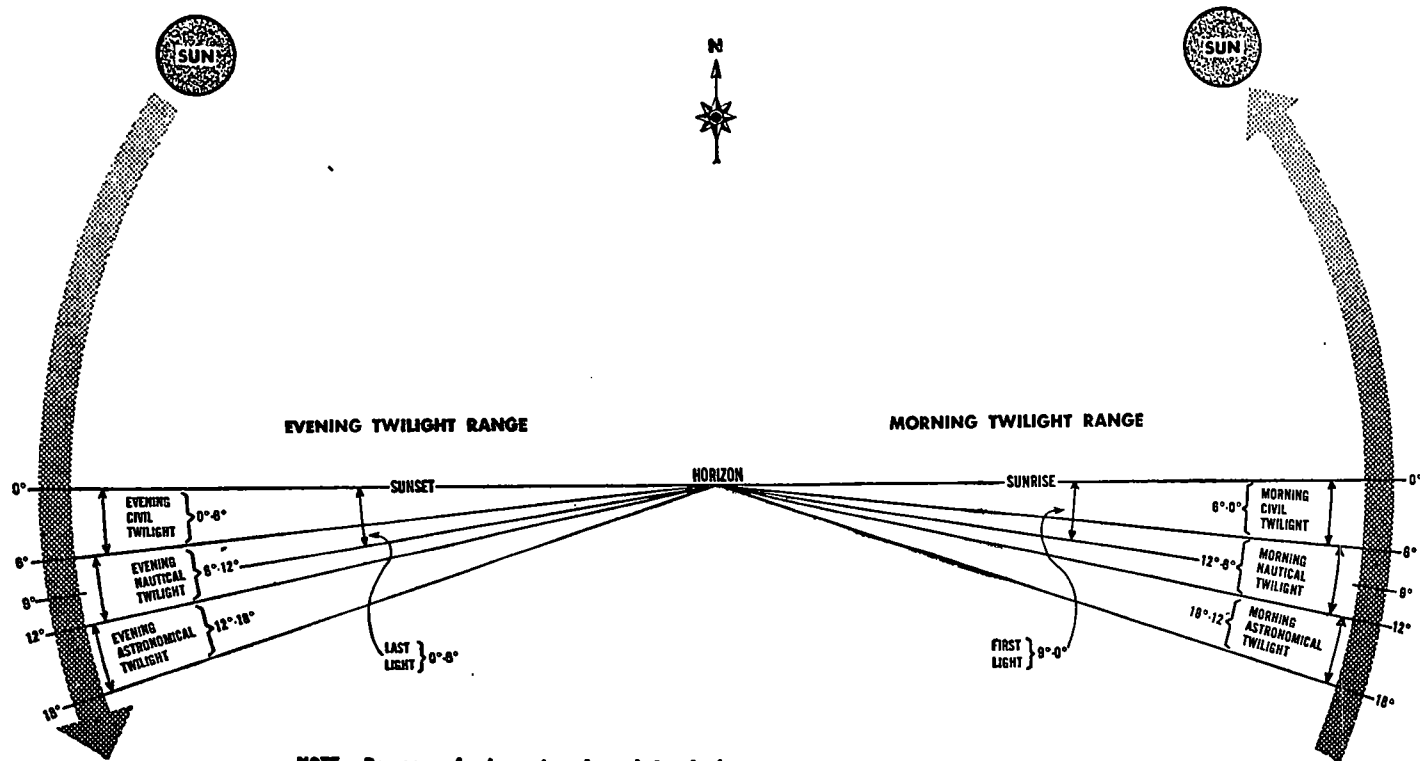
e. *Tides.* The times of the high and low tides are shown by curves in the lower diagram. By noting the sequence of the tides during a day, the height of any particular tide can be found from the upper diagram.

f. *Twilights, morning and evening.*

- (1) Twilights are the periods of solar illumination prior to sunrise and after sunset. Both morning and evening twilights are divided into three periods: astronomical, nautical, and

RESTRICTED

77



NOTE.—Degrees refer to center of sun below horizon.

Twilight factors.

civil. The interval of time between when the upper edge of the sun's disk appears to be exactly on the horizon and the instant the center of the sun is 6° below the horizon is civil twilight, 6° – 12° nautical twilight, and 12° – 18° astronomical twilight.

- (a) Astronomical twilight affords such meager light, if any, that for military purposes it may be considered as a period of darkness.
- (b) Nautical twilight provides enough illumination to carry on most types of ground movement without difficulty, and approaches conditions expected under full light of day. Vision is limited to 400 yards or less. For military purposes, during the nautical periods weapons can be employed within the range of vision stated and daylight calculations relative to movement will apply, including restrictions on such movement. Bomb loading and repair work cannot be carried on without the use of artificial light.
- (c) Civil twilight affords sufficient light to carry on normal day activities. This period is the earliest or latest that provides sufficient natural illumination of targets to allow efficient observed artillery fire or day bombing.
- (d) The above disregards weather and local surroundings (*i* below).
- (2) Except for high latitudes, values for the approximate durations of astronomical, nautical, and civil twilights may be considered equal.
- (3) First light and last light, terms used by the armed forces of the United Kingdom, include a slightly greater period of twilight than defined by civil twilight.

g. Moonlight. For astronomical twilight and solar darkness, periods of moonlight and dim moonlight are shown on the lower diagram. During the period of *moonlight*, the intensity of light will vary between the brightness of the full moon at zenith and about one-third of this value. During the period of *dim moonlight*, the intensity varies from about one-third to one-tenth of the brightness of full moon at zenith.

h. Moon's Phases. The phases of the moon are shown below the day on which they occur.

i. Effect of Weather on Light. Weather has been disregarded in these calculations. Smudge, fog, clouds, refraction, reflection, and precipitation affect the degree of illumination. These factors can be included in the calculations by means of experience tables compiled in the area over a period of time and from meteorological forecasts for the area only.

j. Diagram of Tides, Sunlight, and Moonlight.

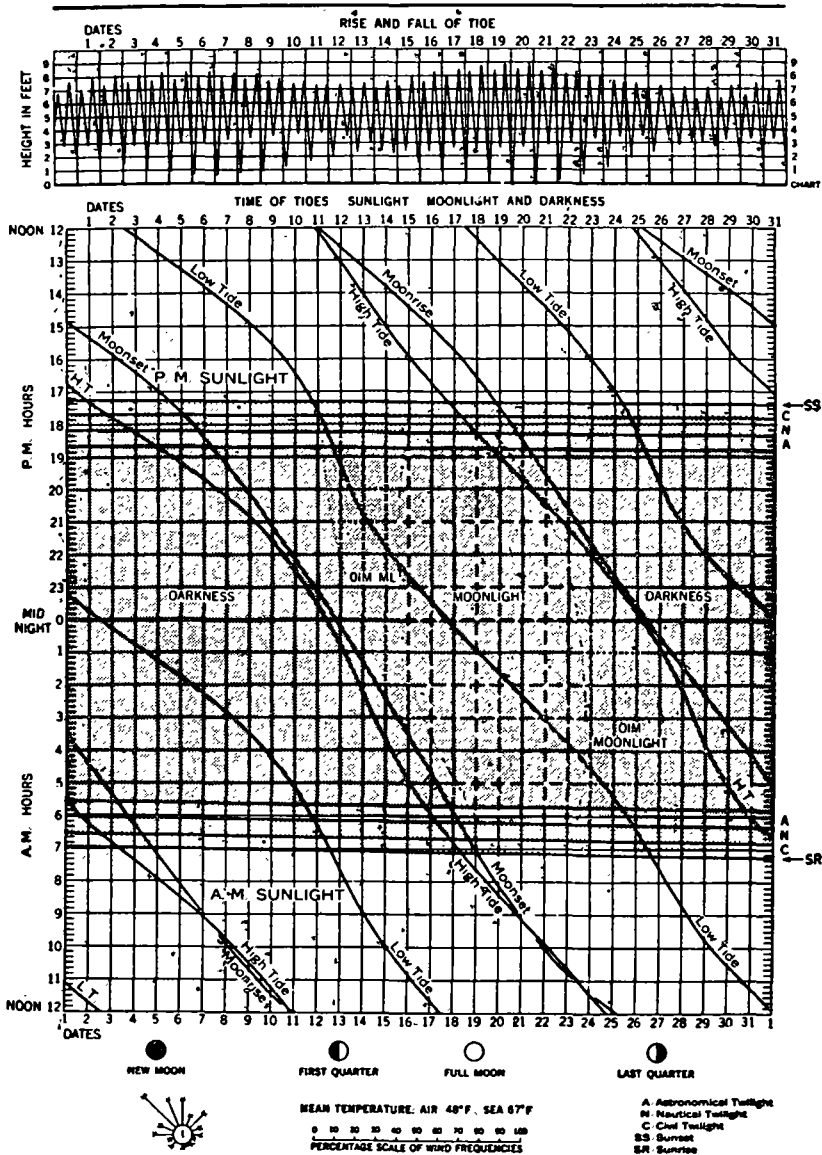
KAGOSHIMA—WAN, KYUSHU *

DECEMBER 1945

Lat 31°30' N., Long 130°40' E.

Time Meridian: 135° E.

Sunlight and Moonlight Data Computed for Lat 31°30' N., Long 130°40' E.



Prepared by the U. S. Coast and Geodetic Survey
 at the request of the U. S. Hydrographic Office

CHAPTER 4
OPERATIONS

Section I. TROOP PLANNING

47. General

a. The number and type of units to be employed in a given operation is determined by: the mission; the character, disposition, and capabilities of the enemy; the terrain; the availability of transportation; and the availability of supplies and equipment.

b. The tables shown in paragraph 48 indicate the numbers and types of combat and service units not organic to the divisions, which might be found in a typical army under average conditions. Such an army is presumed to have three corps of three infantry divisions and one armored division each. The table of organization and equipment is shown in paragraph 48 when the unit is a current type. When the unit listed is a proposed type, the table of organization and equipment of the most comparable current unit is shown in parentheses. In the application of these tables to a specific situation, modifications and adjustments must be made for variations in the composition or size of the force and any peculiarities of the particular situation.

c. The diagrams in paragraph 48 show the schematic layout of the units and the general areas of their operation. They are not intended to show the attachment or assignment of units to corps and divisions except in a very general way, and they are not intended to show the exact location of units.

48. Troop Requirements, Typical Army

a. Armored Units—Numbers and Types.

	1	2	3	4	5
1	Unit	T/O & E	Corps	Army	Total Army
2	Armd Cav Regt (L).....	17-51	1	1	
3	Hq & Hq Co. Armd Cav Gp.....	17-32	1		
4	Tk Bn (Heavy).....	17-35	3		
5	Amph Tk Bn*.....	17-115			
6	Amph Trac Bn*.....	17-125			

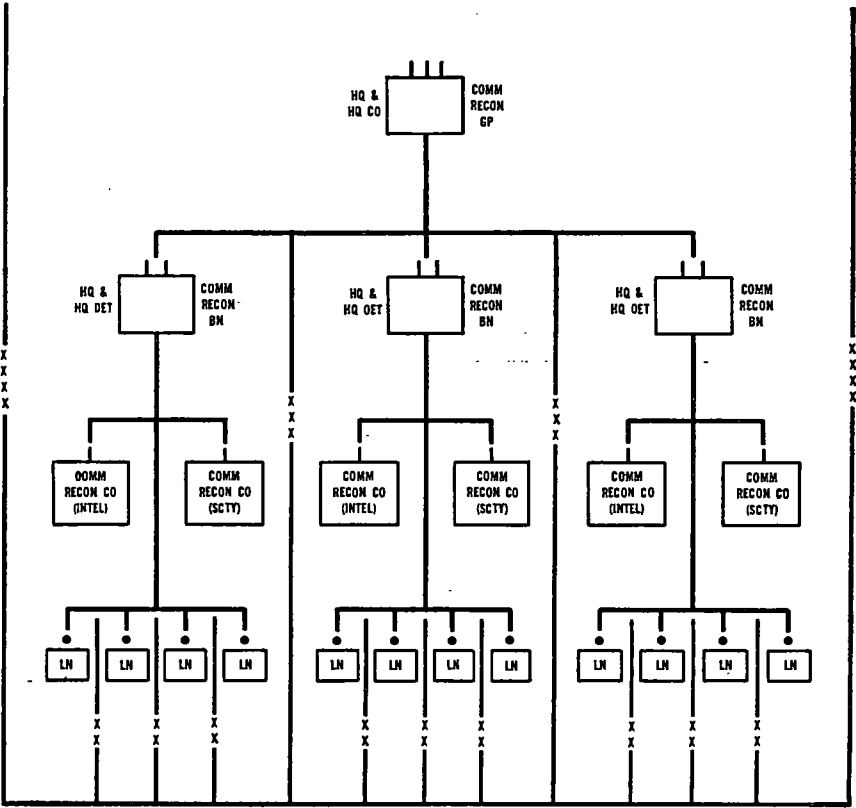
✓ 4 (1 added
3)
9 } (Change)
designation

*As required for amphibious operations.

b. Army Security Agency Units.
(1) Numbers and types—Army Security Agency Units.

	1	2	3	4	5
1	Unit	T/O & E	Corps	Army	Total Army
2	Hq & Hq Co Comm Recon Gp.....	32-500	-----	1	1
3	Hq & Hq Det Comm Recon Bn.....	32-500	1	-----	3
4	Comm Recon Co (Intel).....	32-500	1	-----	3
5	Comm Recon Co (Scty).....	32-500	1	-----	3

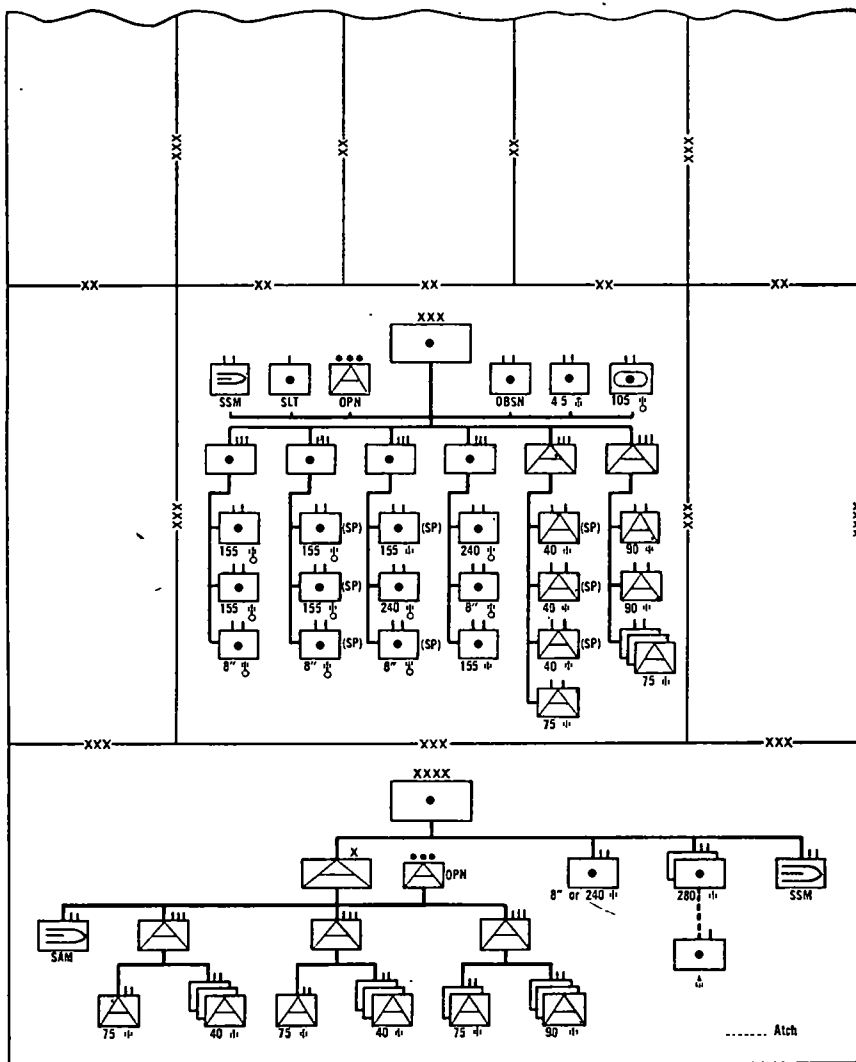
(2) Schematic diagram—Army Security Agency Units.



c. Artillery Units.
(1) Number and types.

	1	2	3	4	5
1	Unit	T/O & E	Corps	Army	Total Army
2	Hq & Hq Btry, Corps Arty.....	6-501	1	0	✓ 3
3	Hq & Hq Btry, FA Gp.....	6-401	4	0	✓ 12
4	FA Obsn Bn.....	6-575	1	0	✓ 3
5	FA Searchlight Btry.....	6-558A	1	0	✓ 3
6	Hq & Hq Btry, AAA Brig.....	44-101A	0	1	✓ 1
7	Hq & Hq Btry AAA Gp.....	44-12A	2	3	✓ 9
8	AAA Opns Det.....	44-7	1	1	✓ 4
9	AAA AW Bn, Mbl.....	44-25	0	6	✓ 6
10	AAA AW Bn, SP.....	44-75	3	0	✓ 3
11	AAA Gun Bn, 90-mm.....	44-15A	2	3	✓ 5
12	AAA Bn L, 75-mm, Mbl.....	44-35	4	4	✓ 16
13	FA Bn, 4.5 in. Rocket.....	6-615	1	0	✓ 3
14	FA Bn, 105-mm How, SP, Armd.....	6-315	1	0	✓ 3
15	FA Bn, 155-mm How, Towed.....	6-135	2	0	✓ 2
16	FA Bn, 155-mm How, SP, Armd.....	6-325	2	0	✓ 2
17	FA Bn, Towed, Hv, 155-mm Gun.....	6-415	1	0	✓ 3
18	FA Bn, Hv, SP, 155-mm Gun.....	6-435	1	0	✓ 3
19	FA Bn, Hv, Towed, 8 in. How.....	6-415	2	0	✓ 2
20	FA Bn, Hv, SP, 8 in. How.....	6-435	2	0	✓ 2
21	FA Bn, VH, Towed, 240-mm How.....	6-515	2	0	✓ 2
22	FA Bn, VH, Towed, 8 in. Gun.....	6-515	0	1	✓ 1
23	FA Bn, 280-mm Gun.....	6-535	0	2	✓ 2
24	Arty Rocket Btry.....	6-538	0	2	✓ 2
25	Guided Missiles Bn SSM.....	6-545	1	1	✓ 2
26	Guided Missiles Bn SAM.....	Proposed	0	1	✓ 1

(2) Schematic diagram—artillery units.

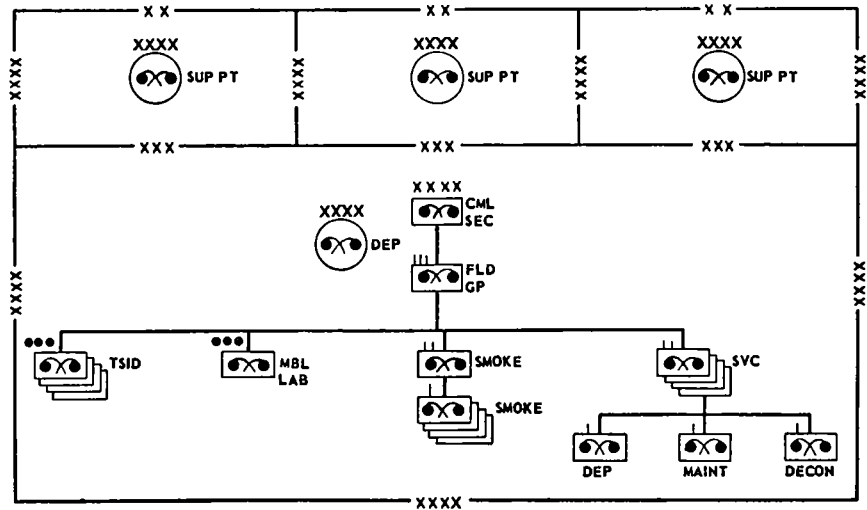


d. Chemical Units.
(1) Number and types—chemical units.

	1	2	3
1	Unit	T/O & E	Total Army
2	Hq & Hq Co, Cml Gp (Fld).....	3-32	✓ 1
3	Hq & Hq Det, Cml Smoke Genr Bn.....	3-266	✓ 1
4	Cml Smoke Genr Co.....	3-267	✓ 4
5	Hq & Hq Co, Cml Bn (Sve).....	3-36	✓ 4
6	Cml Maint Co.....	3-47	✓ 4
7	Cml Depot Co.....	3-67	✓ 4
8	Cml Decon Co.....	3-217	✓ 4
9	Cml Sve Detachments.....		
10	Det IB, Tech Sve Intel.....	3-500	✓ 4

- For command of two to six battalions.
- For command of two to six companies such as chemical depot company, chemical decontamination company, chemical maintenance company and assigned units.

• (2) Schematic diagram—chemical units.

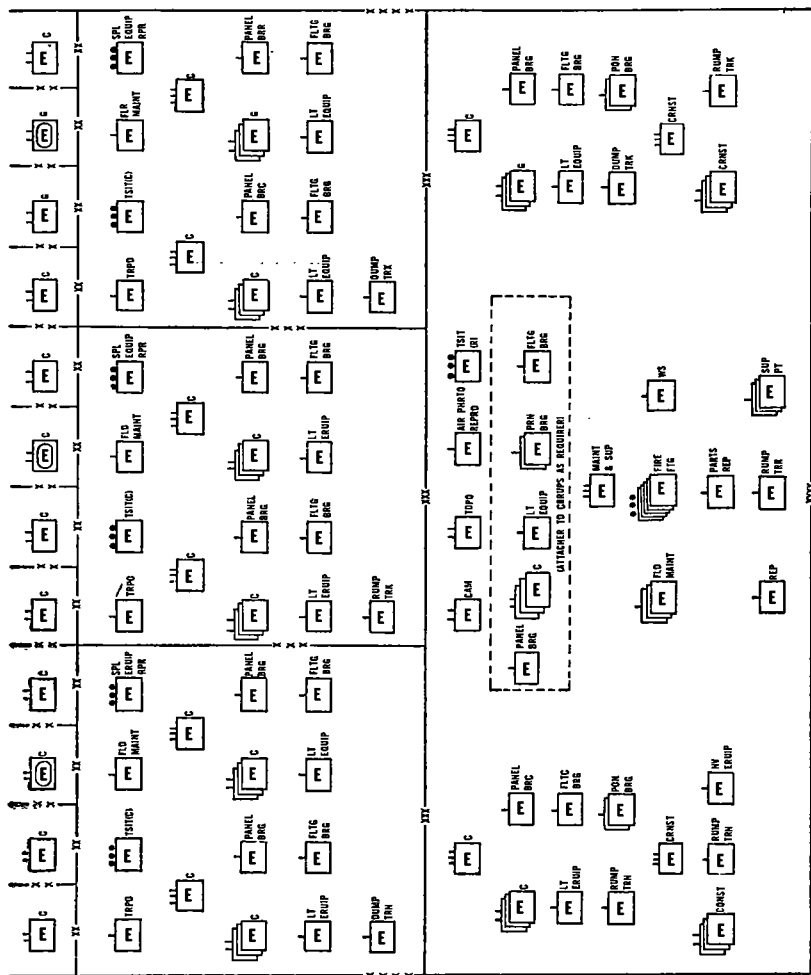


e. *Engineer Units.*

(1) *Numbers and types—engineer units.*

1	1		2	3
	Unit		T/O & E	Total Army
2	Engr Cam Bn, Army.....		5- 95	✓1
3	Hq & Hq Co, Engr C Gp.....		5-192A	✓9
4	Engr C Bn, Army.....		5-35	✓27
5	Hq & Hq Co, Engr Const Gp.....		5-312	✓2
6	Engr Const Bn.....		5-215	✓6
7	Engr Dp Trk Co.....		5-324	✓12
8	Engr Hv Equip Co.....		5-328	✓2
9	Engr L Equip Co.....		5-367	✓9
10	Engr Fltg Brg Co.....		5-138	✓9
11	Engr Pnl Brg Co.....		5-137	✓12
12	Engr Pon Brg Co.....		5-139	✓6
13	Engr Aerial Photo Repro Co.....		5-54	✓1
14	Engr Topo Bn, Army.....		5-55	✓1
15	Engr Topo Co, Corps.....		5-167	✓3
16	Engr Maint & Sup Gp.....		5-262	✓1
17	Hq & Hq Det, Engr Dep Bn.....		5-266	✓1
18	Engr Dep Co.....		5-267A	✓1
19	Engr Sup Pt Co.....		5-48	3
20	Engr Fld Maint Co.....		5-157A	✓1
21	Engr WS Co.....		5-67	✓2
22	Platoon, Fire Fighting.....		5-500	✓5
23	Det, Spl Equip Maint.....		5-500ED	3
24	Engr Tech Intel Team (C).....		5-398T	3
25	Engr Tech Intel Team (R).....		5-399T	1

(2) *Schematic diagram—engineer units.*



f. Infantry Units—Numbers and Types.

	1	2	3	4	5
1	Unit	T/O & E	Corps	Army	Total Army
2	Regt, Sep.....	7-11		2	2
3	Inf Hv Mort Bn.....	7-45	1	1	4

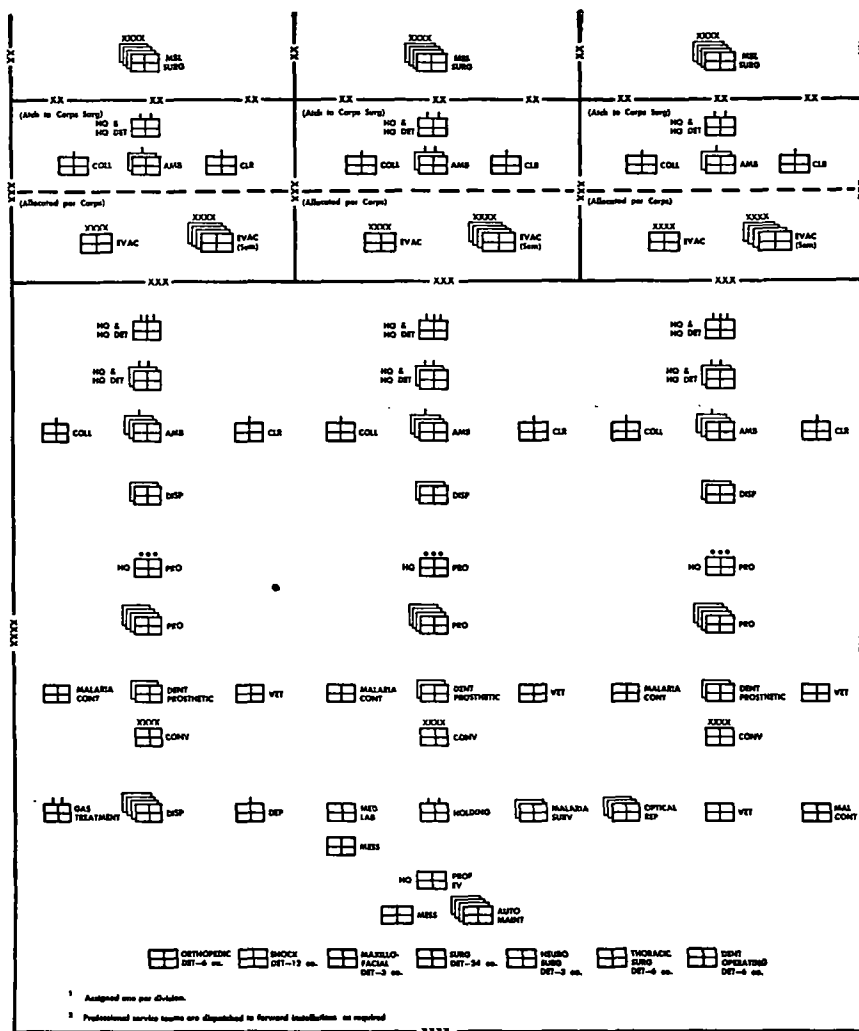
g. Medical Units.

(1) Numbers and types—medical units.

	1	2	3
	Unit	T/O & E	Total Army
1	Hq & Hq Det, Med Gp.....	8-22	✓ 3
2	Hq & Hq Det, Med Bn (Sep).....	8-26	✓ 9
3	Med Coll Co (Sep).....	8-27	✓ 3
4	Med Clr Co (Sep).....	8-28	✓ 9
5	Med Holding Co.....	8-57	✓ 3
6	Med Amb Co (Sep).....	8-317	✓ 15
7	Preventive Med Co.....	8-117,	✓ 3
8	Med Fld Lab, Army.....	8-640	✓ 1
9	Army Med Depot.....	8-667	✓ 1
10	Mbl Army Surg Hosp.....	8-571	✓ 12
11	Evac Hosp, Smbl (400 bed).....	8-581	✓ 12
12	Evac Hosp (750 bed).....	8-580	3
13	Convalescent Center, Army.....	8-590	3
14	Hq, Professional Svc.....	8-500AG	1
15	Optical Det.....	8-500GA	1
16	Optical Det (Augmentation).....	8-500GB	2
17	Vet Food Insp Det.....	8-500JA	4
18	Surgical Det.....	8-500KA	24
19	Orthopedic Det.....	8-500KB	6
20	Shock Det.....	8-500KC	12
21	Maxillo-Facial Det.....	8-500KD	3
22	Neurosurgical Det.....	8-500KE	3
23	Thoracic Det.....	8-500KF	6
24	Gas Det.....	8-500KG	4
25	Dental Svc Det.....	8-500KJ	8
26	Dental Prosthetic Det, Mbl.....	8-500KK	2
27	Psychiatric Det.....	8-500KO	4
28	Gen Dispensary.....	8-500MA	8
29	Medical Det.....	8-500OA	20
30	Helicopter Amb Unit.....	8-500RA	3

RESTRICTED—Security Information

(2) *Schematic diagram—medical units.*



h. Military Police Units—Numbers and Types.

Unit	T/O & E	Total Army
1 MP Bn, Army.....	19-35	3 ✓
2 MP Co, Corps and Army.....	19-37	4 ✓
3 Bn Hq & Hq Det (AD).....	19-500	1 ✓
4 MP EsctGd Co (Mbl).....	19-47A	3 ✓
5 MP Co (Gd) (Fxd).....	19-247	2 ✓
6 CID (ME).....	19-500	3 ✓
7 CID (MD).....	19-500	1 ✓
8 Crime Lab (Mbl) (MG).....	19-500	1 ✓

i. Ordnance Units.

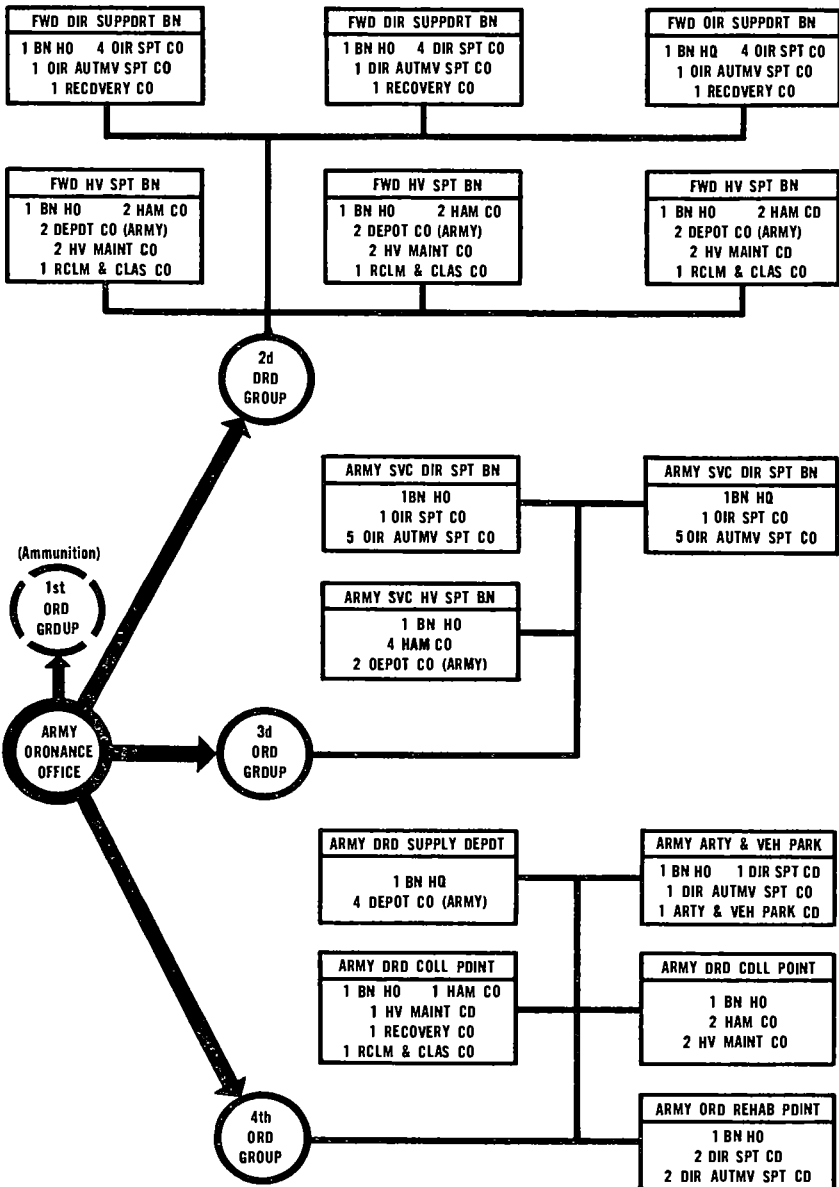
(1) Numbers and types—ordnance units.

Unit	T/O & E	Total Army
1 Hq & Hq Co, Ord Gp.....	9-12	4 ✓
2 Hq & Hq Det, Ord Bn.....	9-76	17 ✓
3 Ord Co, Direct Spt.....	9-7A	17 ✓
4 Ord Co, Direct Autmv Spt.....	9-127A	16 ✓
5 Ord Hv Maint Co (Army).....	9-9	9 ✓
6 Ord HAM Co.....	9-197	13 ✓
7 Ord Dep Co (Army).....	9-57	12 ✓
8 Ord Recov Co.....	9-187	4 ✓
9 Ord Reim and Clas Co (Army).....	9-167	4 ✓
10 Ord Arty & Veh Park Co.....	9-137	1 ✓
11 Ord Ammo Co (Army).....	9-17	10 ✓
12 Ballistic and Tech Svc Det.....	9-500FD	1 ✓
13 EOD Sqd.....	9-500FA	8 ✓
14 Tech Intel Det.....	9-500FE	4 ✓
15 Integrated Fire Ctl Det.....	9-500FH	15 ✓
16 Hv Arty Ord Spt Unit.....	9-49	2 ✓
17 Ord GM Direct Spt Co.....	9-227	5 ✓

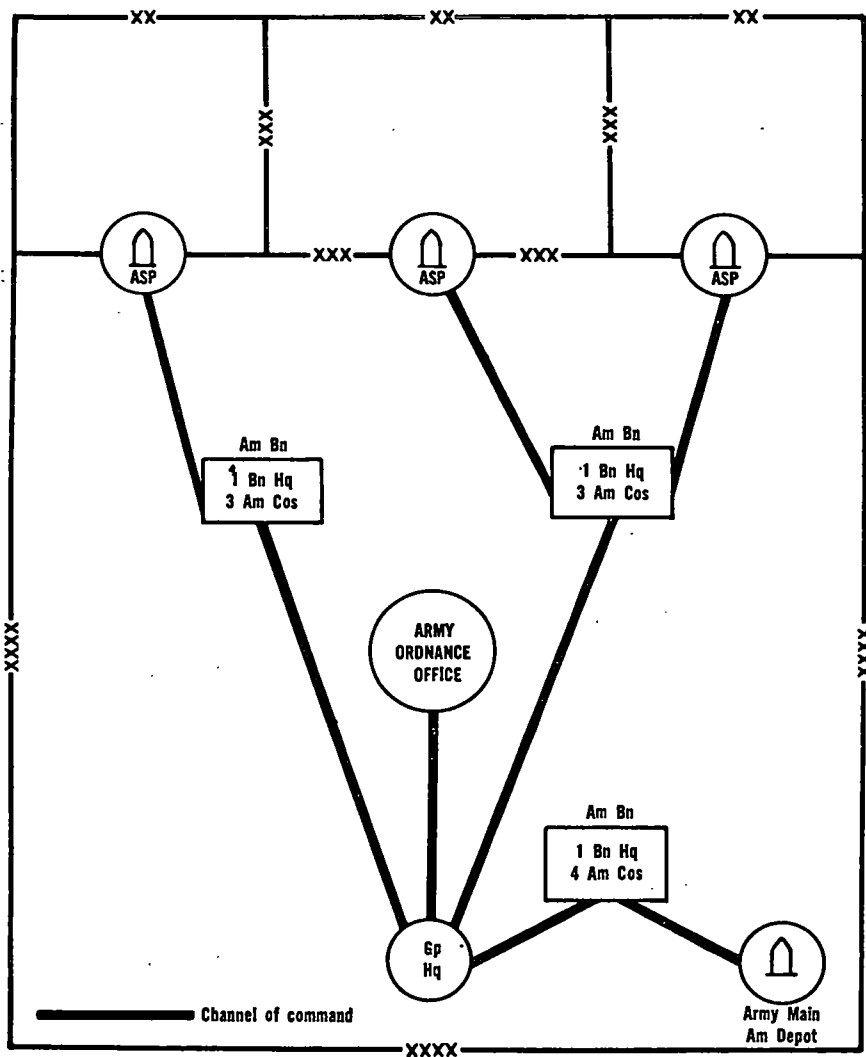
RESTRICTED—Security Information

(2) Schematic diagram—ordnance units.

(a) General supply and maintenance.



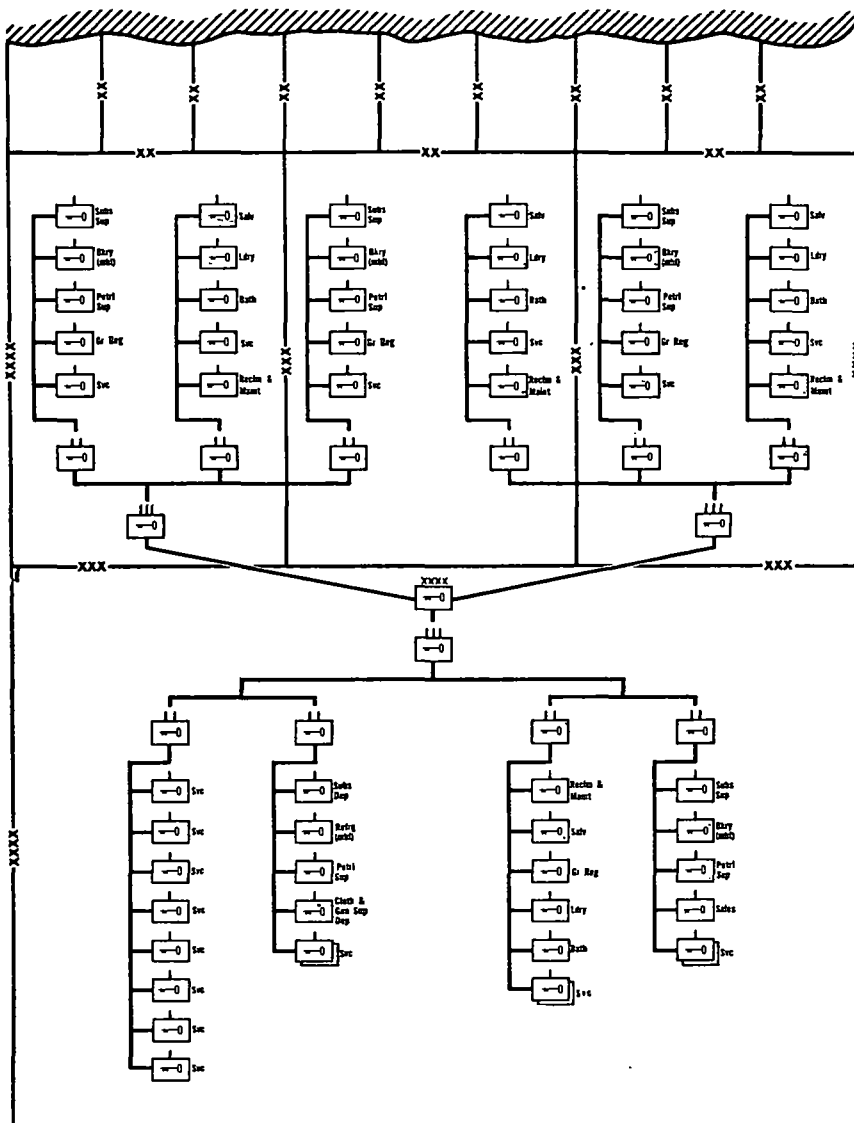
(b) Ammunition supply.



RESTRICTED—Security Information*j. Quartermaster Units.**(1) Numbers and types—quartermaster units.*

	Unit	T/O & E	Total Army
1	Hq & Hq Co, QM Gp.....✓	10-22	3
2	Hq & Hq Det, QM Bn.....✓	10-536	10
3	QM Bkry Co (Mbl).....✓	10-147	4
4	QM Clothing & Gen Sup Dep Co.....✓	10-227	1
5	QM Subs Dep Co.....✓	10-357	1
6	QM Ldry Co (Smb).....✓	10-167	4
7	QM Refrg Co (Mbl).....✓	10-247A	1
8	QM Sales Co, Mbl.....✓	10-157	1
9	QM Svc Co.....✓	10-67	20
10	QM Petrl Sup Co (Mbl).....✓	10-77	5
11	QM Bath Co (Smb).....✓	10-257	4
12	QM Gr Reg Co.....✓	10-207A	4
13	QM Reclm & Maint Co (Smb).....✓	10-237	4
14	QM Salv Co.....✓	10-187	4
15	QM Subs Sup Co.....✓	10-197	4

(2) Schematic diagram—quartermaster units.



RESTRICTED—Security Information

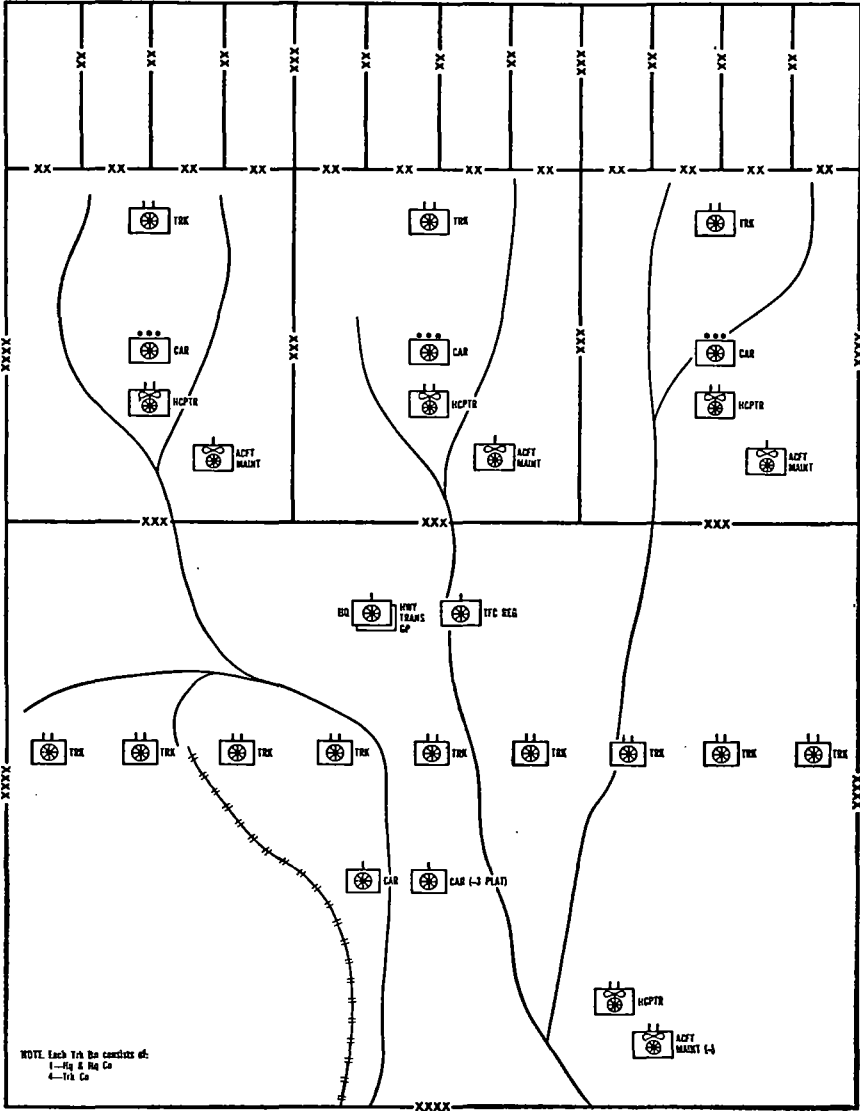
k. Signal Corps Units.

(1) Numbers and types—signal units.

	1	2	3	4	5
1	Unit	T/O & E	Corps	Army	Total Army
2	Sig Bn Corps.....✓	11-15N	1	0	3
3	Hq & Hq Co.....	11-16	(1)	0	(3)
4	Rad & Msg Cen Opn Co.....	11-17	(1)	0	(3)
5	Tp & TT Opn Co.....	11-18N	(1)	0	(3)
6	Const Co.....	11-27N	(3)	0	(9)
7	Hq & Hq Co, Sig Gp.....✓	11-22	0	1	1
8	Sig Const Bn.....✓	11-25	0	2	2
9	Hq & Hq Co.....	11-26	0	(2)	(2)
10	Const Co.....	11-27N	0	(8)	(8)
11	Sig Bn (Opn).....✓	11-95A	0	1	1
12	Hq & Hq Co.....	11-96A	0	(1)	(1)
13	Co (Wire Opn).....	11-97A	0	(1)	(1)
14	Co (Rad Opn).....	11-98A	0	(1)	(1)
15	Co (Msg Cen Opn).....	11-99A	0	(1)	(1)
16	Hq & Hq Co, Sig Spt Bn.....✓	11-116	0	1	1
17	Sig Spt Co.....	11-117	0	(4)	(4)
18	Rep Co.....	11-127A	0	(1)	(1)
19	Dep Co.....	11-128	0	(1)	(1)

RESTRICTED—Security Information

(2) Schematic diagram—Transportation Corps units.



m. Miscellaneous Units—Number and Type.

1	Unit	T/O & E	Total Army
2	Hq, Army.....	51-1	1 ✓
3	Hq Co, Army.....	51-2	1 ✓
4	Hq, Spl Trp, Army.....	51-3	1
5	Hq, Corps.....	52-1	3 ✓
6	Hq Co., Corps.....	52-2	3 ✓
7	Hq & Hq Det, Repl Gp.....	20-52	1 ✓
8	Hq & Hq Det, Repl Bn.....	20-56	6 ✓
9	Repl Co.....	20-57	24 ✓
10	Statistical Accounting Unit, Type C.....	12-510	4
11	Statistical Accounting Unit, Consolidated, Type D.....	12-510	1
12	Army Postal Unit, Type G.....	12-605	3
13	Army Postal Unit, Type H.....	12-605	3
14	Army Postal Unit, Type K.....	12-605	6
15	Sec Disbursing, Fin (AB, BM, CD, DE).....	14-500	3
16	Sec Disbursing, Fin (AC, BM, CB, DE).....	14-500	3
17	Spl Svc Co.....	28-17	1
18	Det, CIC, (AA).....	30-500	12
19	Det, CIC (AB).....	30-500	4
20	Photo Intpr Team.....	30-600	As required
21	Mil Intel Svc Orgn.....	30-600	Variable
22	Mil Govt Gp.....	41-500*	1
23	Mil Govt Co (AB).....	41-500*	3
24	Mil Govt Plat (AA).....	41-500*	12
25	Loudspeaker & Leaflet Co.....	20-77A	1
26	Orgn or Sep Band.....	20-107	1

*Strength figures do not include operational personnel which is variable.

49. Troop Requirements—Communications Zone

Troop requirements in a communications zone vary with the strength supported, the topography, the climate, and the development of the theater. Variation is so great that no type organization of troop units is shown in this paragraph. An outline plan for preparing a communications zone troop list follows.

a. Determine the mission of the communications zone.

- (1) Determine the supported strength. Both the number and type of divisions and supporting combat and service troops within the combat zone must be known. The extent of support required for troops of other services (Navy (including Marine) and Air Force) for allied troops, and civil affairs or military government must be determined.
- (2) Study the mission of the theater to determine the load which will be placed on the communications zone. An active theater requires more communications zone troops than a defense command.

b. Study the territory which will comprise the communications zone. Lines of communications, geography, climate, and extent of develop-

ment all affect the troop list. A survey or estimate of probable destruction from enemy or other causes must be made.

c. Study the political organization, economy, density of population, probable attitude of the inhabitants, and extent of destruction of their installations and local government. Determine whether population will be controlled by military government or by civil affairs support of an existing government. Determine the size and composition of a military government staff for the communications zone headquarters as well as of a national military government headquarters for each nation in the communications zone. Determine needs for military government units by type of occupation and by major and minor political subdivisions of each country. Determine the requirements for psychological warfare forces for an effective consolidated propaganda program. Economy of personnel and established doctrine dictate adherence to existing political boundaries and governmental structure in determining military government requirements.

d. Determine a tentative organization of communications zone to include any necessary division into base, intermediate, or advance sections. The logistical command is a suitable nucleus for a communications zone section.

e. Add troop units of the technical and administrative services to the basic logistical commands as required for the accomplishment of the assigned missions.

f. Each service having been provided with an adequate troop list to accomplish its primary mission, check the troop list to ensure that it includes the following units for installations and headquarters involving more than one service.

- (1) *Adjutant general service.* Postal units at each major headquarters, hospital, port, depot, staging area, and recreation area.
- (2) *Engineer service.* Utilities detachments at each major headquarters, hospital, port, general depot, staging area, and recreation area. Fire-fighting detachments at each city, port, depot, hospital, and troop camp.
- (3) *Finance service.* Finance disbursing sections at each major headquarters, hospital, port, and troop camp.
- (4) *Military police service.* Gate detachments at each major headquarters, hospital, port, and depot. Guard detachments for each train, Military Railway Service.
- (5) *Quartermaster service.* Laundry detachments at each hospital, recreation area, staging area, and troop camp. Quartermaster service companies may be added to port and depot troop lists to increase their capacity with greater

economy in trained manpower than would result if additional port companies, depot companies, and ammunition companies were added.

- (6) *Signal service.* Signal operations detachments at each major headquarters, port, hospital, depot, and troop camp.
- (7) *Bulk allotment.* Sufficient bulk allotment must be provided to furnish personnel for the many headquarters and special organizations, not provided for in tables of organization and equipment. Normally the communications zone headquarters itself is chargeable against the bulk allotment. Headquarters for intersectional services may require tables of distribution from the bulk allotment. Each communications zone section will require a suballocation from the bulk allotment for the organization of district headquarters and recreation area headquarters, and for other special tasks.

g. Make a final check comparing the services to insure that they are balanced with each other.

h. Figures on division slices are given in paragraph 53a. Figures on air wing slices are given in paragraph 53b. The total strength of the communications zone troop list should approximate the sum of the communications zone portions of the division slices and the air wing slices. The following figures are given as a further guide:

- (1) Advance section supporting an independent corps and operating a port, a small military railway service, and an area 50 miles deep by 20 miles wide: 35,000 to 50,000 total; a figure of 40,000 may be used as an early approximation.
- (2) Advance section supporting a balanced field army, and operating a port, a military railway service, and an area 50 miles deep by 50 miles wide: 75,000 to 110,000; a figure of 90,000 may be used as an early approximation.

50. Troop Requirements—Airborne Operations

a. General.

- (1) The troop requirements for an airborne force are determined by the number of airborne and infantry division assigned; the mission; the terrain in the objective area; enemy dispositions and capabilities; availability of aircraft; probable length of time the airborne force must be supported by air lines of communication; the availability of logistical and administrative support; and other pertinent factors. The complete dependence of an airborne force on a single communication system—air lines of communication—until surface link-up is established, requires that troop requirements be

very carefully determined for each specific airborne operation being planned.

- (2) Normally the troop list for the Army component of an airborne force includes those units that will be directly employed in the operation in a combat or supporting role, and does not include units required for the marshalling of the Army forces, or the logistical or administrative support that may be furnished by the communications zone agency designated to mount and support the airborne operation.
- (3) The number of airborne divisions and corps allocated to theaters of operation will vary. Such units will be furnished by the Department of the Army based on Joint Chiefs of Staff directives.
- (4) The Army component of an airborne force is usually responsible for its own logistical support in the airborne objective area, regardless of the size or composition of the Army forces. Therefore, the troop list for the Army component of an airborne force will contain sufficient service troops to provide logistical support in the airborne objective area. In all airborne operations the provision of service support to the Army forces in the objective area by units located in the departure area will be carefully considered and used to the maximum extent permitted by the characteristics of the operation being planned. Usually the nature of the service provided by the units concerned will determine whether they will be assigned to the Army component of the airborne force or to the communications zone agency supporting the operation. Normally the number of Army service troops required in an airborne objective area will be considerably less than the number employed by a ground force containing the same number of divisions.

b. Employment of T/O & E Units. The same types of combat and service troops shown for the typical field army in paragraph 48 will be used to support airborne divisions, infantry divisions, corps and armies used in airborne operations. The number of supporting units used will be scaled down to provide only the requirements of the specific force being organized. Frequently the strength and organic equipment of a supporting unit will be reduced to enhance its air transportability. Lighter equipment may be substituted for heavy equipment. Because of the inherent differences between ground and airborne operations, many of the units shown in paragraph 48 may be omitted from the airborne troop list while others may be assigned to the communications zone agency supporting the airborne operation. Of those units assigned to the Army component of the airborne force,

a portion may operate within the objective area while others will support the operation from the departure area.

c. *Employment of Special Units.* Special units or T/O & E units with special training and equipment are required for certain airborne operations, particularly those of the independent type.

- (1) Engineer construction battalions which have been specially equipped and trained for airfield construction are required when airfields must be repaired or constructed during the early stages of an airborne operation.
- (2) Specially organized, trained, and equipped units are required to provide air terminal facilities in the airhead when large tonnages of supplies and equipment will be delivered by air for a prolonged period. Normally this support will be provided by Air Force units.
- (3) The number and types of the special units required will be determined separately for each airborne operation based on such factors as the airfield repair and construction requirements in the objective area; the tonnage of supplies and equipment to be received in the objective area via air transportation; and the method of supply distribution that will be used in the objective area.

51. Troop Requirements—Amphibious Operations

The table shown below is designed to determine the units required in addition to the units organic and normally attached to regimental combat teams, divisions, and corps to provide a balanced shore party troop list for an amphibious assault. Troop assignment (in the table) is based on a corps with three divisions in the assault. The factors used as a basis for determining the troop requirements can only be used to provide an estimate of requirements. Modifications and adjustments must be made to meet the peculiarities of a particular situation.

Typical Shore Party Troop List

	1	2	3	4	5
	Unit	T/O & E	Per RCT ^{1 2}	Per Inf Div ^{1 2}	Per Corps ^{1 2}
1					
2	Hq & Hq Co, Amphibious Support Brigade (ASB). ³	20-301	-----	-----	1
	Engineer Units:				
3	Amph Spt Regt, ASB ²	20-511	-----	1	3
4	Engr Shore Bn ²	5-525	-----	1	3
5	Engr Shore Co ²	5-527	1	-----	-----
6	Engr Fld Maint Co, ASB ²	5-157	-----	-----	1
7	Engr Combat Bn (Army).....	5-35	-----	.1	3
8	Engr Combat Co.....	5-37	1	-----	-----

See footnotes at end of table.

RESTRICTED—Security Information*Typical Shore Party Troop List—Continued*

	1	2	3	4	5
	Unit	T/O & E	Per RCT ¹	Per Inf Div ¹	Per Corps ¹
	Engineer Units—Continued				
9	Engr Sup Pt Co.....	5-48		1	3
10	Engr Lt Equip Co.....	5-367			1
	Chemical Units:				
11	Cml Smoke Genr Co.....	3-267		1	3
12	Cml Sup Det.....	3-500		1	3
	Medical Units:				
13	Med Det, ASB ²	20-300			1
14	Med Bn (Sep) ³	8-26			1
15	Med Amb Co (Sep).....	8-317			1
16	Med Clr Co (Sep).....	8-28			1
17	Med Coll Co (Sep).....	8-27			1
	Ordnance Units:				
18	Ord Maint Co, ASB ²	9-97			1
19	Ord Dir Autmv Spt Co.....	9-127A ⁴			1
20	Ord Depot Co (Army) ⁴	9-57			1
21	EOD Sqd.....	9-500		1	3
22	Ordnance Ammo Co. ⁵	9-17			1
	Signal Units:				
23	Signal Co, ASB ² ⁴	11-537			1
24	Signal Depot Det.....	11-500		1	3
	Quartermaster Units:				
25	QM Co, ASB ²	10-277			1
26	QM Svc Co.....	10-67		1	4
27	Hq & Hq Det, QM Bn.....	10-197		1	3
28	QM Subs Sup Co.....	10-197		1	3
29	QM Petrl Sup Co (Mbl).....	10-77		1	3
	Transportation Units:				
30	Trans Boat Bn, ASB ²	55-515		1	3
31	Trans Boat Co. ³	55-517	1		
32	Trans Boat Maint Bn, ASB ² ⁴	55-555			1
33	Trans Boat Maint Co. ³	55-557		1	
34	Trans Harbor Craft Co, ASB.....	55-9			1
35	Hq & Hq Co, Trans Trk Bn. ⁶	55-16		1	3
36	Trans Trk Co.....	55-17		2	6
37	Trans Amph Trk Co.....	55-37		2	6
38	Hq & Hq & Svc Co, Trans Port Bn.....	55-116		1	3
39	Trans Port Co, Type A.....	55-117	1	3	9
	Military Police Units:				
40	Military Police Bn, Army.....	19-35			1
41	Military Police Co, Corps and Army.....	19-37		1	3
42	Military Police PW Guard Det.....	19-500		1	3
	Navy Units:				
43	Naval Beach Group ⁷	USN		1	3
	Air Force Units.....			(⁸)	(⁸)

¹ T/O & E units shown under columns 4 and 5 can be broken down and assigned to support subordinate commands as the situation may require.

² Figures in column 4 include those in column 3, figures in column 5 include those in column 4.

³ Units organic to ASB. Remaining units are normal attachments to the ASB when acting as the shore party for a corps in amphibious operations.

⁴ Detachments may be attached to divisions when ASB headquarters is not employed.

⁵ Detachments usually attached to divisions.

⁶ Organic to amphibious support regiment.

⁷ Less boat unit if ASB boats are employed.

⁸ Air Force service elements to support Air Force units with the landing force.

52. Troop Planning Slices

a. Purpose. In logistical planning, a preliminary estimate of the total size of a force is required in order to determine the final composition and the ultimate size of the force, for the required number of many service units, such as hospitals, depot units, etc., bears a direct relationship to the size of the total force. Two factors are used in such planning, the *division slice* and the *wing slice*. To determine the preliminary total of the force, multiply the division slice by the number of divisions in the force and add the product thus obtained to that of the wing slice multiplied by the number of wings in the force; to the sum thus obtained must be added the various miscellaneous forces not included in either slice.

b. Definitions.

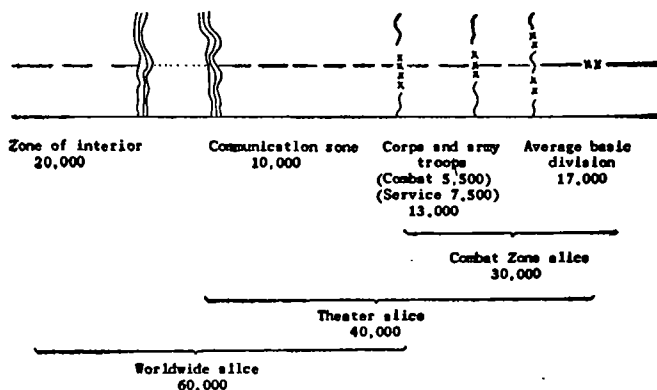
- (1) The division slice includes the strength of an average combat division plus proportionate shares of the total corps, army, communications zone, and zone of interior (for worldwide slice only) units operating to the rear of the division (and of Naval units directly supporting the Marines in case of Marine divisions). The division slice for any given force is equal to the total strength of the force divided by the number of combat divisions in the force.
- (2) The *wing slice* includes the strength of an average wing plus a proportionate share of the Air Force and Army units engaged in developing or operating the air bases (and of Naval units which directly support the Marine or Naval Air units).

c. Relation Between Division Slice and Wing Slice. During World War II, each Army division slice of 40,000 men was balanced by two Air Force group slices of 5,000 men each. The 5,000-man group slice included about 1,000 Army communications zone men, not counted in the division slice, required for communications zone support of Air Force units and installations present in the theater of operations. In the charts in *d* below, and in *a* and *b* above, this same assumption is made: the wing slice and not the division slice contains the communications zone support for Air Force. This allows troop planners to use these tables with varying ratios of air wings to army divisions in any specific force.

d. Basic Slice Factors. (See pars. 124 and 265 for location of slice components as contrasted with assignment of slice components shown here.)

RESTRICTED—Security Information

- (1) *Division slice* (United States Army troops only):



- (2) *Wing slice* (United States Air Force combat and service troops, United States Army troops serving with the Air Force, and United States Army troops present because Army supports Air Force in certain functions):

			AF service 1,200	AF combat 1,300
Gom Z troops present in theater to support AF 1,000	Army Tech Svs with AF 900	Hq, Sv, misc. 600	Basic wing 2,500	
	Total AF wing slice, incl Tech Svs with AF 4,000			
	Theater wing slice 5,000			

- (3) *Amphibious assault and build-up.* Initially in an amphibious assault, all elements are smaller than shown in (1) and (2) above and reach the strength shown there gradually during build-up. Division slices varying from 22,000 to 30,000 men have proved satisfactory in the long range planning estimation of strengths for an amphibious assault including follow-up. The value of 25,000 is recommended for general planning purposes. The number of vehicles to be landed with assault troops is estimated on the basis of 1 vehicle per 10 men for long voyages, 1 vehicle per 7 men for short voyages (due to differences in types of shipping). Division slices varying from 35,000 to 40,000 men have proved satisfactory in the estimation of peak strengths, achieved between D+30 and D+90, in an amphibious

operation. The value of 40,000 men is recommended for general planning purposes. The number of vehicles to be landed in build-up for a force is estimated on the basis of providing enough to increase the ration of vehicles per man to 1 vehicle to 5 or 6 men of the total (assault and build-up) force.

53. Division and Wing Slices

a. Division Slice. The following table presents the percentages of each arm, service, and other major grouping present in each part of a large balanced force. It is based on troop deployment at the end of World War II. This troop deployment contained 89 divisions: 5 airborne, 16 armored, 1 cavalry, 66 infantry, and 1 mountain. This table has been modified to conform to postwar studies on the composition of the field army, the postwar division, the consolidation

Division Slice

Branch or other major groupings	World-wide slice		Theater slice		Combat zone slice		Division only
	Total (60,000 men)	Z/I portion (20,000 men)	(Army)		(Army)		(17,000 men)
			Total (40,000 men)	Com Z portion (10,000 men)	Total (30,000 men)	Corps and army (rear portion) (13,000 men)	
Combat Division	28.3	0	42.5	0	56.7	0	100
Hq units, AG, FD, Spl Svc, and other administrative and intelligence services incl operating overheads (including for Z/I defense command overheads and Dept of Army agencies)	5.4	9.5	3.3	9.0	1.4	3.2	0
Armor	1.7	.3	2.4	.1	3.1	7.2	0
Arty	6.2	1.6	8.5	.1	11.3	26.1	0
Cml	.8	.2	1.1	.8	1.2	2.8	0
CE	7.8	4.0	9.7	12.9	8.7	20.0	0
MP	1.1	.9	1.2	2.2	.8	1.9	0
Inf	1.0	.4	1.3	.2	1.7	3.9	0
Army Medical Service	5.9	4.9	6.4	17.2	2.8	6.5	0
Ord Corps	3.8	1.8	4.8	7.4	3.9	9.0	0
QMC	4.4	2.6	5.3	15.8	1.8	4.2	0
SC	2.9	1.7	3.5	7.5	2.2	5.1	0
TC	5.8	5.0	6.2	17.4	2.4	5.5	0
Repls	10.2	23.0	3.8	9.4	2.0	4.6	0
Bulk Pers Z/I only	9.3	27.0	0	0	0	0	0
Misc Z/I only	5.4	16.2	0	0	0	0	0
Total percent	100	100	100	100	100	100	100
Percent of world-wide slice	100	33.3	66.7	16.7	50	21.7	23.3
Percent of theater slice			100	25	75	32.5	42.5
Percent of combat zone slice					100	43.3	56.7

RESTRICTED—Security Information

of all artillery in one arm, the consolidation of cavalry, armored, and tank destroyer units into one armor branch, the transfer of certain truck and car units from Quartermaster Corps to Transportation Corps, and the separation of the Air Force from the Army. The communications zone column does *not* include those Army communications zone troops who must be present to support the Air Force (see par. 52*b* and *c*).

b. Wing Slice. This table presents the percentages of component, branch, and other major groupings present in the theater of operations. It is based on Air Force troop deployment of 30 June 1945, at which time 213 groups were deployed overseas. Figures of 30 June 45 have been modified to reflect the "wing" organization current in the Air Force and to take into account changes in concept of logistical support of air operations.

Theater Wing Slice

	1	2	3	4	5	6	7
	Component, branch, or other major grouping	Theater total 5,000 men	Army Com-Z in support of A.F., incl. theater overhead 1,000 men ¹	Air Force			
				Total 4,000 men	Hq, Sv, and misc 600 men (300 Hq and misc) (300 Sv)	Tech Svs with AF 900 men ²	Basic wing 2,500 men (1,300 combat) (1,200 service) ³
	Air Force:						
2	Hq and overhead.....	6.0	-----	7.5	4 50	-----	-----
3	Combat.....	26.0	-----	32.5	-----	-----	52
4	Service Dep.....	6.0	-----	7.5	4 50	-----	-----
5	Service Fld.....	24.0	-----	30.0	-----	-----	48
6	Theater and Com-Z Hq, Misc, and Overhead.....	3.1	10	1.3	-----	6	-----
	Technical Services:						
7	Cml.....	.9	2	.7	-----	3	-----
8	Engr.....	11.2	22	8.6	-----	38	-----
9	Med.....	4.4	20	.5	-----	2	-----
10	Ord.....	2.6	5	2.0	-----	9	-----
11	QM.....	5.4	16	2.7	-----	12	-----
12	Sig.....	7.0	8	6.7	-----	30	-----
13	Trans.....	3.4	17	-----	-----	-----	-----
14	Total Percent.....	100	100	100	100	100	100
15	Percent of wing slice.....	100	20	80	12	18	50

¹ Army communications zone troops required in the theater due to presence of Air Force units requiring Army administrative support.

² Primarily construction, transportation, and maintenance units assigned to Air Force in the theater. Does not include medical troops organic to wing (only technical service so assigned).

³ Located on the combat airfield, includes all elements organic to wing.

⁴ Includes various air headquarters, miscellaneous detachment, control and warning units, etc.

⁵ Primarily Air Force depot troops.

Section II. TACTICAL TROOP MOVEMENTS

54. Movement on Foot

a. Introduction. Troop movement data as given in tables of basic road spaces and tables of rates and lengths of marches are averages from field experience.

Examples: Examples of forms for troop movement tables are included as guides for the preparation of similar tables for units in the field. Tables for field use must conform to the variations of strength of units and the amount of transportation and equipment available. Regiments, separate battalions, and similar units should maintain tables showing road space requirements of their units based on actual strength and material on hand. Reports of subordinate units form the basis for tables of large units. However, a table based on actual strength of men and material may be worthless without proper evaluation of the weather, road conditions, hostile air and mechanized threats, or other variable factors affecting the troop movement. These basic figures are capable of great increase or decrease under extremes of the variable factors.

b. Basic Road Spaces. The following values apply in computing road spaces except when greater dispersion is desired to reduce the effect of unfavorable factors mentioned in *a* above:

(1) *Foot troops (at halt or marching):*¹

	Yards
Single file, per man.....	2.3
Single file, tactical conditions, per man.....	5.3
In column of twos, per man.....	1.5
In column of threes, per man.....	1.3
In column of fours, per man.....	1.2

(2) *Motor elements (at halt):*²

	Road space (yards) ¹
Car, passenger.....	8
Half-track or armored personnel carrier.....	8
Tank.....	8
Tank with cargo trailer or weapon in tow.....	11
Tractor, M-18.....	7
Tractor, M-18 with cargo trailer or weapon in tow.....	15
Tractor, 5-ton with semitrailer 10-ton, 25; S & P.....	14

See footnotes, page 108.

RESTRICTED—Security Information**(2) Motor elements (at halt)—Continued**Road space
(yards) ¹**Trucks:**

¼-ton.....	5
¼-ton with cargo trailer or weapon in tow.....	8
½- or ¾-ton.....	6
½- or ¾-ton with cargo trailer or weapon in tow.....	10
1½- or 2½-ton.....	9
1½- or 2½-ton with cargo trailer or weapon in tow.....	16
Over 2½-ton.....	9
Over 2½-ton with cargo trailer in tow.....	13
6-ton cargo (treadway).....	14
Average per vehicle for a mixed column of various types...	10

(3) Use of values.

- (a) A battalion of infantry with 800 men marching in column of threes: 800×1.3 (see (1) above) = 1,040 yards road space.

- (b) A mixed motor column consisting of—

	Yards
20 trucks, ¼-ton, with weapons in tow at 8 yards each.....	160
25 trucks, ¾-ton, with trailer in tow at 10 yards each.....	250
75 trucks, 1½-ton, at 9 yards each.....	675
40 trucks, 2½-ton, with trailers in tow at 16 yards each.....	640
40 tanks at 8 yards each.....	320

200 Total

Total road space at halt..... 2,045

Alternate solution (see (2) above):

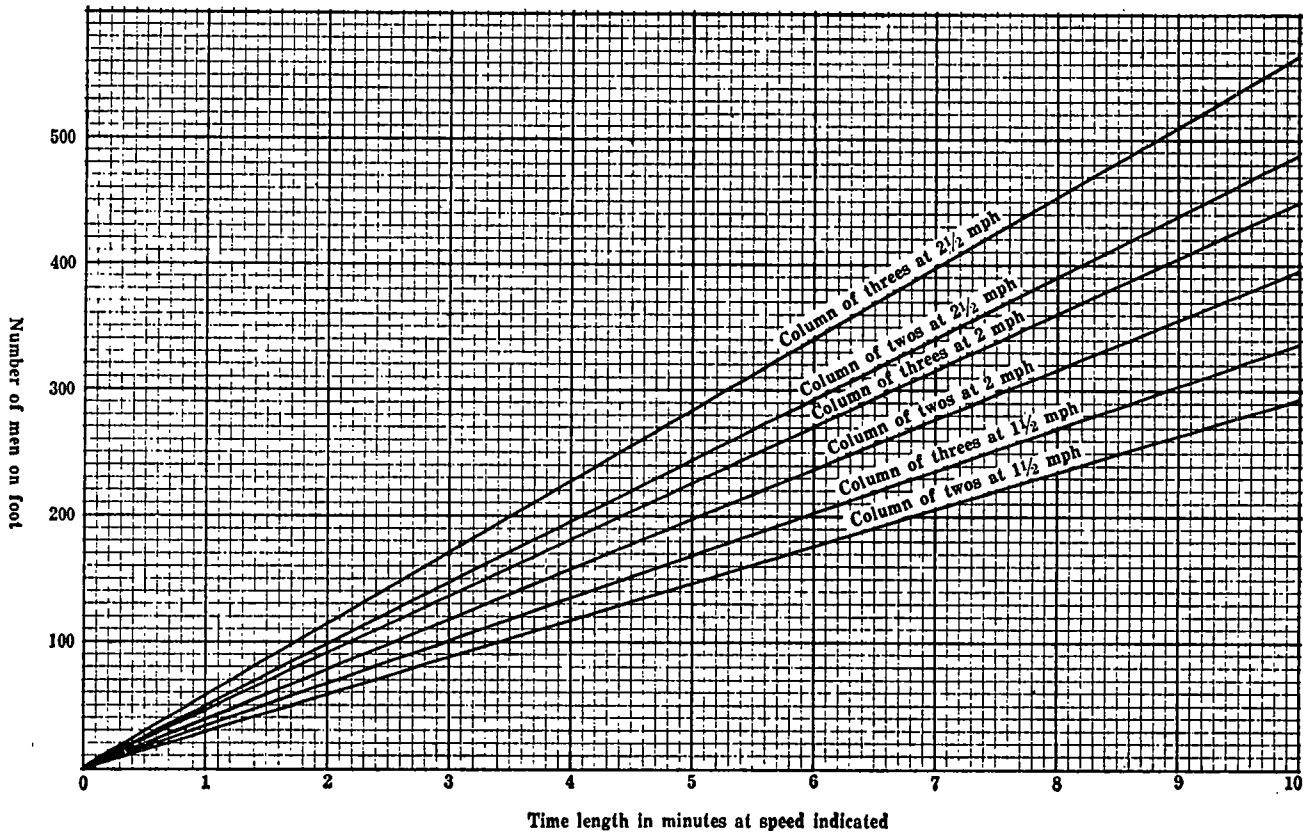
200 vehicles (mixed) at 10 yards each..... 2,000

¹ For time length of foot elements in column see c below. Factors include normal distances between units.

² For road spaces and time lengths for motor elements at various rates of march see paragraph 55f.

³ Allows 1 to 2 yards between vehicles. See chapter 5 for actual lengths of vehicles, towed weapons, and trailers.

c. Average Time Lengths of Columns on Foot.



d. Rates and Lengths of Marches; Foot, Animal, and Motor Elements.*

(1) The following rates and lengths of marches are based upon modern vehicles, trained personnel, and favorable conditions of roads and weather:

1	1	2	3	4	5	6	7
	Unit	Rates of march (mph) ¹				Lengths of march on roads (miles per day average) ³	Remarks
		On roads ²		Cross country			
		Day	Night	Day	Night		

INFANTRY ⁴

2	Foot troops.....	2½	2.....	1½	1	12-15 for a division, 15-20 for smaller units.	Length of march increased with well-seasoned troops marching on good roads in favorable weather when required by the tactical situation. ⁵
---	------------------	----	--------	----	---	--	---

ARTILLERY

3	Pack (less motor elements).	3½	3.....	3	2	20	
4	Truck-drawn, light or medium.	25	25 (lights)..... 10 (no lights).	8	5	175	
5	Tractor-drawn medium (M5).	21	15 (lights)..... 10 (no lights).	10	4	150	
6	Truck-drawn, heavy.	18	18 (lights)..... 10 (no lights).	6	4	135	
7	Tractor-drawn, heavy.	15	15 (lights)..... 10 (no lights).	6	4	135	
8	Antiaircraft artillery, truck-drawn.	20	20 (lights)..... 10 (no lights).	8	5	175	
9	Antiaircraft artillery, self-propelled.	20	20 (lights)..... 10 (no lights).	12	5	175	
					(lights) (1½ no lights).		
					(lights) (1½ no lights).		

ARMORED

10	Tanks, light and armored personnel carriers.	20	(Lights)..... 10 (no lights).	12	5	150	Armored division moves at rate of march of medium tanks.
11	Tanks, medium.....	15	15 (lights)..... 10 (no lights).	5	3	100	

See footnotes at end of table.

	1	2	3	4	5	6	7
1	Unit	Rates of march (mph) ¹				Lengths of march on roads (miles per day average) ²	Remarks
		On roads ³		Cross country			
		Day	Night	Day	Night		

MISCELLANEOUS

12	Pack train.....	3½	3.....	3	2	20	Single vehicles or small columns of less than 50 vehicles.
13	Infantry division, motorized.	15	15 (lights).....			150	
14	Trucks and ambulances.	25	25 (lights).....			150	
			10 (no lights).				
15	Cars, passenger.....	35	35 (lights).....			250	
			10 (no lights).				

¹ Rate of march is average speed over a period of time, including short, periodic halts.

² Rates of march for motorized elements listed in columns 2 and 3 are possible only on improved roads.

³ Greater distances than those given in column 6 may be covered under forced march conditions.

⁴ For movement over mountainous terrain, an additional allowance of 1 hour should be made for each 1,000 feet of climb.

*The rate of march of a column composed of elements with different rates of march is regulated by that of the slowest element.

(2) *Marches in snow and extreme cold.*

- (a) Foot troops marching in snow without snowshoes or skis will have their mobility decreased. The decrease of mobility will depend on several factors, among which are depth and nature of the snow. Normally, snow of a depth of 24 inches or more will prohibit marching unless skis or snowshoes are used. For specially equipped and adequately trained troops, the following rates of march are practicable:

Snowshoes..... 1½ to 2½ miles per hour.

Skis..... 1½ to 3½ miles per hour.

Small bodies of well-trained troops are capable of moving 40 miles a day on skis, under favorable conditions.

- (b) *Dog teams.* Average dog teams of seven dogs hauling a 500-pound load are capable of moving 5 to 7 miles per hour for 6 to 7 hours daily, an average day's march being approximately 30 miles.

- (c) *Motor movement (wheel) in snow:*

Depth snow (inches) Measures required for movement

3..... None.

6..... Rear chains.

6-18..... Chains all around; and special traction devices on leading vehicles (to break the trail).

18 and over..... Snow plow required.

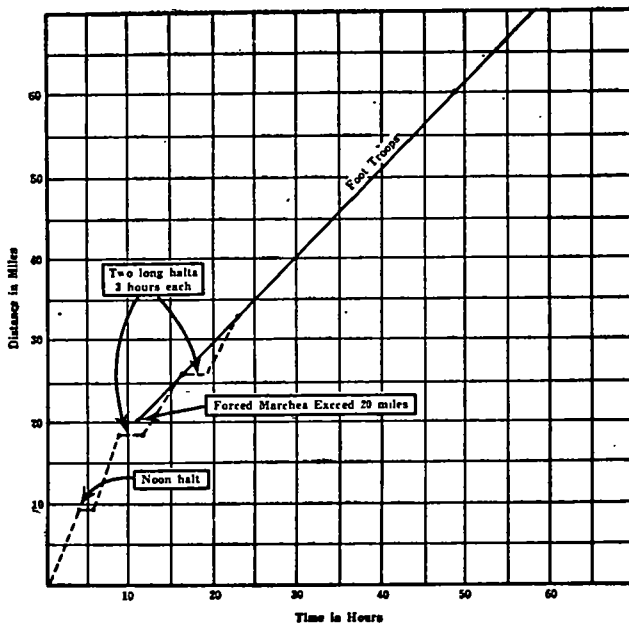
e. *Forced Marches of Foot Elements.*

- (1) *General.* Seasoned troops when well rested at the beginning of the march, with good weather and good roads, are capable of reaching their destination physically fit to engage in combat after making forced marches (marches in excess of 20 miles) as indicated in the graph in (3) below.
- (2) *Examples of use of graph.* Assume it is desired to start a column of foot troops at daylight and accomplish a march of 33 miles. The graph shows that this distance will require a minimum elapsed time of 22½ hours. Such a march might be divided as follows:

	Hours
Total elapsed time.....	22½
First stage, 18 miles. At 2½ miles per hour (daylight, on roads) and allowing for a noon halt of about 1½ hours, the time required for this stage is.....	9
Second stage, 15 miles. At 2 miles per hour (night, on roads) the time required for this stage is.....	7½
Total for both stages.....	16½
Available for a long rest halt between stages.....	6

The forced march could be divided into three or more stages instead of two, in which case two or more long rest halts totaling 6 hours could be scheduled (illustrated by dotted line on graph).

- (3) *Forced march graph.* The most important point to keep in mind when planning forced marches is that the *rate of march is not increased*. The increase is in the number of marching hours per day.



55. Movement by Motor

a. Vehicle Capacities.

- (1) *Truck capacities for personnel.* The capacity of motor transportation for movement of foot troops depends upon the rated capacity of the transportation employed, the type of body on the vehicles, the method of carrying personnel, and the distance personnel are to be moved. Normal capacities for trucks carrying personnel with rifles, packs, and extra ammunition, with no additional cargo, are—

	Men
Truck, ½-ton (excluding driver).....	3
Truck, ¾-ton (excluding driver).....	8
Truck, 1½-ton (excluding driver).....	15
Truck, 2½-ton or larger (excluding driver).....	21

Note.—When 2½-ton engineer dump trucks, or 2½-ton short wheelbase artillery trucks carry the loads shown above, some personnel will be required to stand.

- (2) *Truck capacities for horses or mules:*

Truck, 1½-ton (exceptional).....	2 plus 2 men with equipment.
Truck, 2½-ton, cargo.....	4 plus 4 men with equipment.

RESTRICTED—Security Information

b. Forms for Tabulating Number of Trucks Required for Movement by Motor Transport. The following form may be used to tabulate the approximate number of trucks required to move foot elements with individual equipment.

	1	2	3	4	5	6
	Unit	Actual strength	Transported in organic motors	Strengths for which transportation must be furnished	Number of trucks required	
					1½-ton	2½-ton
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						

c. Traffic Flow of Motor Columns. By traffic flow of motor columns is meant the total number of vehicles passing a given point in a certain time. Traffic flow usually is expressed in vehicles per hour and can be determined for any route by this formula:

Traffic flow in vehicles per hour=

$$\text{Density in vehicles per mile} \times \text{rate in miles per hour} \times F.$$

F (a variable) depends upon the standing operating procedure time intervals between march units and serials applicable in the area and upon the over-all state of proficiency of units operating in the area in motor movement and traffic control. For adaptation to a specific area under field conditions, it is necessary that time and space studies be conducted continuously in order to arrive at a suitable factor. This study may result in a basic factor to which allowance for time gap between march units and serials must be added, or a basic factor including allowance for time gap between march units and serials.

d. *Density of Motor Columns.*

- (1) The density of a motor column is defined as the number of vehicles per mile of road space occupied by vehicles. Motor columns may be classified as either close column, open column, or infiltration.
 - (a) *Close column.* In close column, vehicles are closed to safe driving distance behind the preceding vehicle. Usually a fixed speedometer multiplier (SM)* is specified (such as 2, 2.35, 2.5, 3, etc.) to accomplish a safe-driving intervehicular distance at all speeds.
 - (b) *Open column.* In open column, distances between vehicles are increased to accomplish greater dispersion. Usually a fixed density is specified (such as 10, 15, or 20 vehicles per mile) but open column conditions may be obtained by designating a fixed speedometer multiplier high enough to insure the desired intervehicular lead at the lowest speed expected.
 - (c) *Infiltration.* In infiltration, vehicles are dispatched at irregular intervals with a fixed density (such as 3, 4, 5, or 6 vehicles per mile).
- (2) To determine the density of a motor column, when the rate of march and speedometer multiplier are known, use the following formula:

$$\text{Density} = \frac{1,760 \text{ (yards per mile)}}{\text{Rate (mph)} \times \text{SM}}$$

for example: with a rate of march of 20 mph and a SM of 2, vehicle density equals:

$$\frac{1,760}{20 \times 2} = 44 \text{ vehicles per mile.}$$

e. *Average Road Spaces and Time Lengths of Motor Columns at Various Rates of March.*

- (1) *Road space.* The road space occupied by a motor column may be obtained when the number of motor vehicles in the column (disregarding trailers and towed weapons), the average density (number of vehicles per mile), and the total of the time gaps between subordinate units is known.

$$\text{Road space (miles)} = \frac{\text{Number of motor vehicles}}{\text{Density (vehicles per mile)}} + \frac{\text{Time gaps (min)} \times \text{rate (mph)}}{60}$$

*Speedometer multiplier (SM) is any number by which speed in miles per hour is multiplied to determine intervehicular lead in yards. *Example:* with a SM of 2, the intervehicular lead of two successive vehicles (measured from head to head) at a speed of 10 mph is $2 \times 10 = 20$ yards; at a speed of 25 mph, it is $2 \times 25 = 50$ yards.

RESTRICTED—Security Information

The chart in *f* below shows the average road space under ideal conditions and does not include allowances for intervals between march units. Actual road space may vary somewhat depending upon conditions.

To use chart:

Determine the number of motor vehicles in column, disregarding trailers or towed weapons.

Locate the figure on vertical scale at left of chart, marked "number of vehicles."

Locate the figure showing average density under which the movement will be made, on the vertical scale marked "Density, veh/mi."

Connect these two points with a straightedge. Read the figure at the point of intersection of the straightedge with the vertical scale marked "Road space, miles."

This will be the road space, in miles, occupied by the column under the given conditions.

- (2) *Time length.* The time length of a column is the space of time between the instant the head of a column passes a given point and the tail of the column passes the same point. The time length may be determined by the following formula:

$$\text{Time length (min)} = \frac{\text{Road space (miles)} \times 60}{\text{Rate of march (mph)}}$$

An approximation of time length may be determined by the following:

$$\begin{aligned} \text{Time length (min)} &= \text{No. of vehicles} \times 0.08 \text{ (less than 50 vehicles in close column).} \\ &= \text{No. of vehicles} \times 0.12 \text{ (50 or more vehicles in close column).} \\ &= \text{No. of vehicles} \times 0.20 \text{ (less than 50 vehicles in open column).} \\ &= \text{No. of vehicles} \times 0.24 \text{ (50 or more vehicles in open column).} \end{aligned}$$

f. Road Space and Time Length Chart. The following chart shows average time lengths under ideal conditions and does *not* include allowances for time intervals between march units. Actual time length may vary somewhat depending upon conditions.

To use chart:

Obtain road space as directed in *e*(1) above.

Locate the figure representing the rate of march in miles per hour on the vertical scale marked, "Rate of march, mi/hr."

Connect these two points with a straightedge.

Read the figure at the intersection of the straightedge with the vertical scale marked "Time length."

This figure is the time length of the column under the conditions given.

Number
of
vehicles

Road
space

(miles)

Rate
of
march

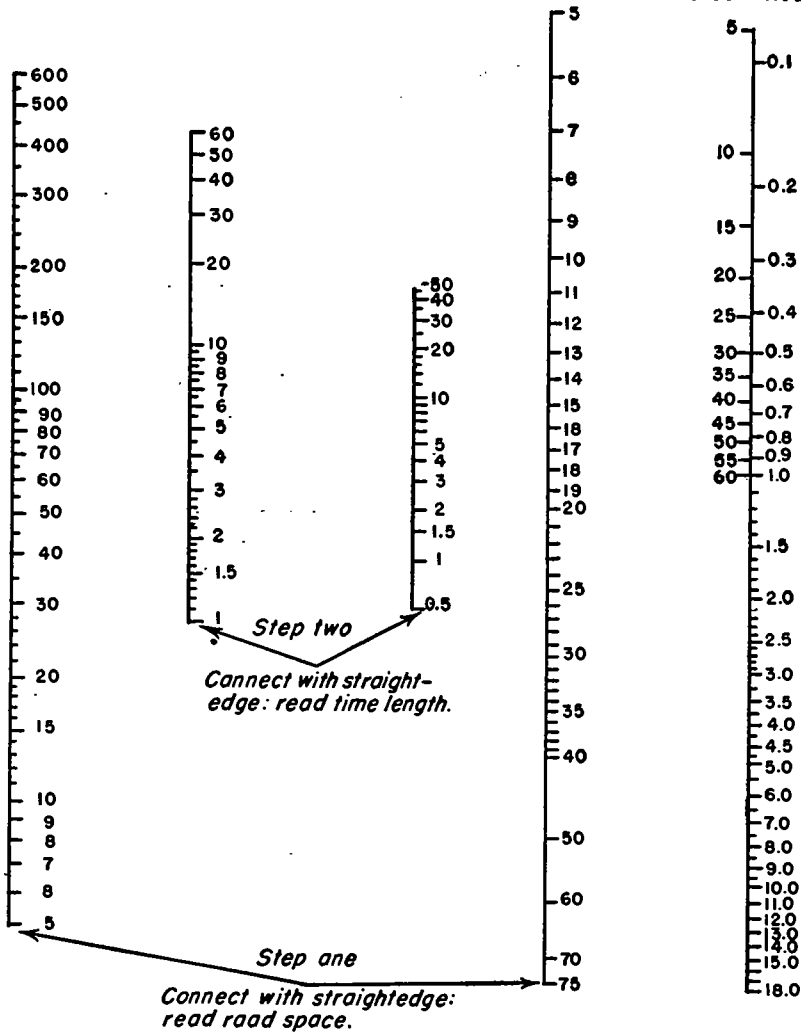
(mph)

Density

(vehicles
per mile)

Time
length

Minutes Hours

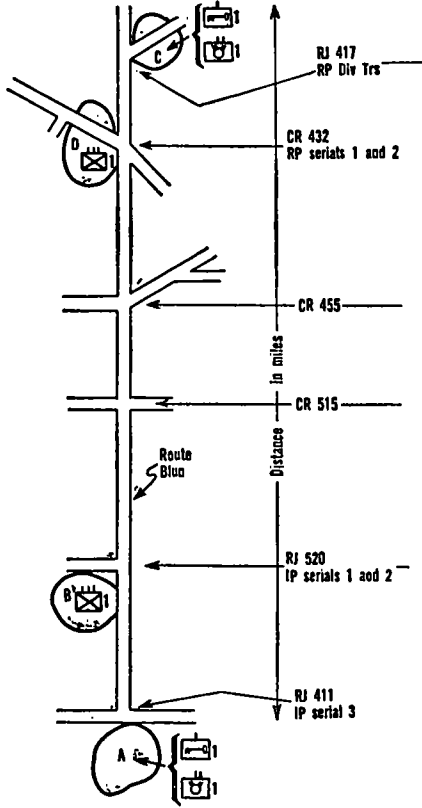


g. March Graphs and March Tables.

- (1) The operation order for a march may be accompanied by a march table, particularly when the details of the march are not subject to change and can be foreseen.
- (2) A march graph is the simplest method of obtaining data required for a march table or order. It shows the approximate location at any hour of the head or tail of each serial, providing the march proceeds as scheduled. The vertical scale to the left, with point of origin at the bottom, serves as a distance scale in miles and should show the relative locations, along the route, of critical points where coordination of the movement is required. The horizontal scale provides a time scale in hours, beginning at the left with the earliest hour at which the first serial may start the march.
- (3) A serial is represented graphically by drawing a line to represent the movement of the head of the serial and a line to represent the movement of the tail of the serial. The lines are parallel and are drawn with a slope that represents the rate of march. (At 10 miles per hour, the slope equals 10 miles on the vertical to 1 hour on the horizontal scale.)

h. Example of March Graph, and March Table. See graph.

- (1) The 1st Infantry Division commander has directed that the 1st Ordnance Battalion, 1st Quartermaster Company, and the 1st Infantry, move under cover of darkness from their present bivouacs, areas A and B, to areas C and D.
- (2) Vehicles of the three infantry battalions will move during the night 26-27 October.
- (3) Foot troops of regiment, motor vehicles of regiment (less battalion vehicles), and vehicles of quartermaster and ordnance companies will move during the night 27-28 October. (Movement to begin at 271900 October and be completed by 280430 October.)



Annex 1 (March Table) to Opn O 2
Map: Operation map

March Table

1st Inf Div
KETOKU (1210-3365)
271500 Oct 19----

1	2	3	4	5	6	7	8	9	10	11	12
Serial No.	Organization and commander	Present location	Route	Location by 0330 28 Oct	March			Control of movement			Remarks
					Rate (mpb)	Type	Time length (min)	Location of critical points	Earliest arrival time	Latest clearance time	
1	Col Able, 1st Inf, Comdg..... Foot troops 1st Inf..... 2,109 men.	Area B..	Blue....	Area D..	2	Column of twos...	54	RJ 520 (IP)..... CR 515..... CR 455..... CR 432 (RP).....	1900 2036 2136 2312	1954 2130 2230 0006	
2	Lt Col Baker, 1st Inf, Comdg .. Motor elements 1st Inf (—). 142 vehicles.	Area B..	Blue....	Area D..	10	Close column.....	18	RJ 520 (IP)..... CR 515..... CR 455..... CR 432 (RP).....	0001 0021 0033 0052	0019 0039 0051 0110	
3	Capt Cain, 1st Ord Bn, Comdg. Portion of Div Trs: 1st Ord Bn..... 1st QM Co..... 169 vehicles.	Area A..	Blue....	Area C..	10	Close column.....	21	RJ 411 (IP)..... RJ 520..... CR 515..... CR 455..... CR 432..... RJ 417 (RP).....	0016 0034 0054 0106 0125 0134	0037 0055 0115 0127 0146 0155	

DISTRIBUTION: Same as Opn O 2.

OFFICIAL:

/s/ Smith

SMITH, G-3

JONES
Maj Gen



1

2



Columns 2, 3 and 9: Based on periodic reports of subordinate units.

Column 6: Group which normally precedes main body to new area for reception of troops.

Column 7: Vehicles not required for immediate support, such as kitchen, baggage motor maintenance, are designated field trains.

Column 10: Number of men on foot (Col. 9) $\times 1.3 = \text{yd} \div 1,760 = \text{miles}$.

Column 11: Number of men on foot (Col. 9) $\times 1.5 = \text{yd} \div 1,760 = \text{miles}$.

Columns 12 and 13; 24 and 25;

(No. of vehicles $\div$ density $+$ $\frac{^3 \text{ time intervals (min.)} \times \text{rate (mph)}}{60}$) = miles

Columns 14, 15, and 16: $\frac{\text{road space (Col. 10)} \times 60}{\text{rate (mph)}} = \text{minutes}$.

Columns 17, 18, and 19: $\frac{\text{road space (Col. 11)} \times 60}{\text{rate (mph)}} = \text{minutes}$.

Columns 20, 21, 26 and 27: $\frac{\text{No. of vehicles} \times 60}{\text{density} \times \text{rate (mph)}} + (^3 \text{ time intervals (min.)}) = \text{minutes}$.

Column 22: Number of men on foot (Col. 9) $\div 25$ except to ensure tactical integrity.

Line 43: Combat team is composed of: Inf Regt; FA Bn, 105-mm; Engr C Co; AAA AW Btry; SP; Det, Ord Bn; and Det Sig Co.

Line 44: Division troops are composed of: Div Hq & Hq Co (-); Sig Co (-); Div Arty (-); MP Co (-); Tk Bn; Engr C Bn (-); and Med Bn.

Line 45: Division trains are composed of: Rr Ech Div Hq & Hq Co; Det Sig Co; Det MP Co; QM Co; Ord Bn (-); Repl Co; and Fld Tns.

For further information of breakdown, see following pages.

¹ In computing men on foot, first consideration is given to the prescribed loads of the vehicles. After this prescribed load is placed on vehicles, the remaining capacity is loaded with personnel.

² The 21 men who normally walk are distributed as follows:

4 aid men with ea Rifle Co.....	12
Aid men with Hv Wpn Co.....	3
Aid men with Hq & Hq Co.....	5
Surgeon with Bn C. O.....	1

21

³ Time intervals within a serial average 1 minute per 25 vehicles (not considered when serial consists of less than 50 vehicles). Time interval between serials is 15 minutes.

RESTRICTED—Security Information

i. Table of Road Spaces and Time Lengths—Infantry Division.
(1) Example:

LINE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
	UNIT	Actual strength								Road space (miles)				Time length (minutes)								Additional Veh to carry foot Trp (Colm 9) (3½-T Trk)	Total Veh In march Colm when unit moves by Trk (Colm 8 + Colm 22)	Road space (miles)		Time length (minutes)	
		Off and EM	Organic Veh	Recon party	Dispersed along route	Veh in advance party	Veh in field trains	Veh In march Colm	Men on foot	Men on foot halted or moving		Vehicles in march Colm (Colm 8)		Men on foot						Veh in march Colm (Colm 8)				Vehicles of units Mtz (Colm 23)		Vehicles of units Mtz (Colm 23)	
										Colm of threes	Colm of twos	Close Colm 75 Veh/mi 10 mph	Open Colm 20 Veh/mi 15 mph	Colm of threes			Colm of twos			Close Colm 75 Veh/mi 10 mph	Open Colm 20 Veh/mi 15 mph			Close Colm 75 Veh/mi 10 mph	Open Colm 20 Veh/mi 15 mph	Close Colm 75 Veh/mi 10 mph	Open Colm 20 Veh/mi 15 mph
														1½ mph	2 mph	2½ mph	1½ mph	2 mph	2½ mph								
1																											
2	Inf Div.....	18,180	2,588	38	39	92	235	2,184	6,546	4.8	5.4	53.5	146	192	144	117	216	162	132	322	584	261	2,445	58.7	161	353	646
3	3 Inf Regt (ea).....	3,662	340			10	44	286	2,182	1.6	1.8	5.7	17.0	64	48	39	72	54	44	34	68	87	373	6.8	21.5	42	87
4	Hq and Hq Co.....	277	50			2	1	47	132			.6	2.4							4	10	2	49	.6	2.4	4	10
5	Svc Co.....	183	58			2	34	22	141			.3	1.1							2	5	2	24	.3	1.2	2	5
6	Hv Mort Co.....	182	30				2	28				.4	1.4							3	6		28	.4	1.4	3	6
7	Tk Co.....	151	32				3	29				.4	1.5							3	6		29	.4	1.5	3	6
8	Med Co.....	208	23				4	19	263			.2	1.0							2	4	3	22	.3	1.1	2	5
9	3 Inf Bn (ea).....	887	49			2		47	682	.5	.6	.6	2.4	20	15	12	24	18	15	4	10	28	75	1.0	3.8	7	16
10	Hq and Hq Co.....	117	17			2		15	57			.2	.8							2	3	3	18	.2	1.0	2	4
11	Hv Wpn Co.....	158	17					17	55			.2	.9							2	4	3	20	.3	1.1	2	5
12	3 rifle Co (ea).....	204	5					5	190	.1	.2	.1	.3	4	3	3	8	6	5	1	1	8	13	.2	.8	2	3
13	Div Arty.....	3,541	725			26	54	645				12.9	38.6							78	155		645	12.9	38.6	78	155
14	3 FA Bn 105-mm How (ea).....	650	136			6	10	120				2.4	7.2							15	29		120	2.4	7.2	15	29
15	3 FA Btry (ea).....	136	24			1	1	22				.3	1.1							2	5		22	.3	1.1	2	5
16	FA Bn 155-mm How.....	636	123			6	8	109				2.2	6.5							14	27		109	2.2	6.5	14	27
17	3 FA Btry (ea).....	139	22			1	1	20				.3	1.0							2	4		20	.3	1.0	2	4
18	AAA AW Bn (SP).....	735	140			2	16	122				2.4	7.3							15	30		122	2.4	7.3	15	30
19	4 AW Btry (ea).....	145	26				2	24				.3	1.2							2	5		24	.3	1.2	2	5
20	Div Hq & Hq Co, Band, and Med Det.....	404	57			7		50				.6	2.4							4	10		50	.6	2.4	4	10
21	Fwd Ech Div CP.....	161	43			5		38				.5	1.8							3	8		38	.5	1.8	3	8
22	Rr Ech Div CP.....	243	14			2		12				.1	.6							1	2		12	.1	.6	1	2
23	Engr C Bn.....	897	165	2		1	6	156				2.7	8.7							17	35		156	2.7	8.7	17	35
24	4 Engr C Co (ea).....	166	24				1	23				.3	1.1							2	5		23	.3	1.1	2	5
25	Med Bn.....	320	78			1	2	75				1.5	4.5							9	18		75	1.5	4.5	9	18
26	Amh Co.....	86	37				1	36				.5	1.8							3	8		36	.5	1.8	3	8
27	Clr Co.....	139	20				1	19				.2	1.0							2	4		19	.2	1.0	2	4
28	MP Co.....	183	55		39	7	3	6				.1	.3							1	1		6	.1	.3	1	1
29	Det with Div Tns.....	12	3				3																				
30	3 MP Tfc Plat (ea).....	34	13		13																						
31	Ord Bn.....	332	104			1		103				2.1	6.3							13	25		103	2.1	6.3	13	25
32	Ord Co Fwd.....	165	50			1		49				.6	2.4							4	10		49	.6	2.4	4	10
33	Ord Co Rr.....	134	47					47				.6	2.4							4	10		47	.6	2.4	4	10
34	Det with ea CT.....	49	15					15				.2	.8							2	3		15	.2	.8	2	3
35	QM Co.....	250	83			1		82				1.6	4.9							10	20		82	1.6	4.9	10	20
36	Recon Co.....	169	39	36			3													1	1		3		.2	1	1
37	Repl Co.....	39	4			1		3												9	17		72	1.5	4.4	9	17
38	Slg Co.....	371	88			15	1	72				1.5	4.4							1	1		3		.2	1	1
39	Det with ea CT.....	14	3					3												1	1		4		.1	1	1
40	Det with Rr Ech CP.....	34	6			2		4				.1	.2							1	1		4		.1	1	1
41	Tk Bn.....	688	170			2	34	134				2.7	8.1							17	33		134	2.7	8.1	17	33
42	3 Tk Co (ea).....	151	32				3	29				.4	1.5							3	6		29	.4	1.5	3	6
43	Combat team (ea).....	4,686	544			16	57	471	2,182	1.6	1.8	9.4	28.3	64	48	39	72	54	44	56.7	113	87	558	11.0	33.5	66.6	133.6
44	Div Trp.....	3,190	748	2	39	37	58	612				12.1	36.6							73.0	146.4		612	12.1	36.6	73	146.4
45	Div Tn.....	763	169			7	235	397				8.0	24.0							47.8	96		397	8.0	24.0	47.8	96



(2) *March organization for use with table of road spaces and time lengths:*

	1	2	3	4	5	6	7	8	9	10
1	Unit	Precedes march column	Pre- cedes march column	Dis- persed along route	Serial 1	Serial 2	Serial 3	Serial 4	Serial 5	Total
		Advance party	Rcn party		Combat team 1	Combat team 2	Combat team 3	Div Trs	Div Tns	Organic vehicles
2	Combat Teams.	(3 × 16) 48			452	452	452		(Fld Tns) 3×57 =171 (Fld Tns)	48+3(452)+ 171=1,575
3	Div Trps....	34						633	59	726
4	Div Tns.....	10							186 (Fld Tns)	196
5	Rcn Co. Engr.		38						3	41
6	Rcn Sec.		2							2
7	MP Traf Plats.....			(3×13) 39						39
8	Totals.....	92	40	39	452	452	452	633	419	2,579
		Not in march column			Total in march column					
		171			2,408					
		Total organic vehicles								
		2,597								

j. Average Time Factors—Infantry Division.

- (1) These data pertain to G-3 time factors considered after a division receives a movement order. They give the times required by the command for—
 - (a) Making preparations before the leading vehicle can arrive at the IP (initial point).
 - (b) Completing the motor march and making preparations to launch a coordinated attack.
- (2) The preparations before the leading vehicle can arrive at the IP include transmission of orders by division; assembling trucks; spotting trucks; map reconnaissance of routes, de-trucking areas, and assembly areas; issue of extra ammunition; briefing of troops; and other normal preparations for an anticipated movement. This preparation pertains to the *first* trip, whether the division is completely motorized by attached transportation and moves in one trip, or whether

RESTRICTED—Security Information

the division moves by organic transportation in two or more trips (echelon). The earliest time in which the leading vehicle can pass the IP after receipt of the order by the division commander is—

- | | <i>Hours</i> |
|---|--------------|
| (a) If the order was received in daylight for a daylight march, for example, received at 1000, leading vehicle can cross IP at 1130----- | 1½ |
| (b) If the order was received at night for a night march, for example, received at 2200, leading vehicle can cross IP at 2400----- | 2 |
| (c) If the order was received in daylight for a night march, for example, received at 1100, leading vehicle can cross IP 1 hour after EENT----- 1 hr after EENT
(For EENT see par. 46.) | |
| (d) If the order was received at night for a daylight march, and more than 2 hours prior to BMNT, for example, received at 0200, leading vehicle can cross IP at BMNT----- (For BMNT, see par. 46).
(If the order was received less than 2 hours prior to BMNT, the time is the time the order was received plus 2 hours.) | |

Note.—To determine corresponding time factors for a foot march instead of a motor march, use ½ hour less in (a), (b), and (c) above.

- (3) The factors considered in computing time to complete a march and to make preparations for launching a coordinated attack are dependent upon whether the march is made by echelon or completed in one trip. The following time factors in (a), (b), (c), and (d) below are applicable only when the march is made by echelon. The time factors shown in (e), (f), (g), (h), and (i) below apply to any motor move and outline the procedure used in determining the earliest time at which an infantry division can launch a coordinated attack. These factors are based upon the assumption that the infantry division can launch a coordinated attack when two assault battalions of each assault regiment are in position behind the line of departure. Since the closing of these assault battalions requires more time than the preparation and movement of the other attack forces, supporting units such as

artillery, reserves, etc., will be in position prior to closing of the assault battalions on the line of departure. The factors are further based upon the assumption that these assault battalions will be the leading elements of the march serials.

	Day	Night
(a) Dump basic loads.....	15 min.	30 min.
(b) Load basic loads.....	30 min.	60 min.
(c) Reassemble trucks for each trip made in convoy.....	20 min.	40 min.
(d) Entruck personnel.....	10 min.	20 min.
(e) Complete the motor march from the old area to the new area.....	See above.	

Note.—If the release point (RP) is approximately 3 miles from the detrucking point (DP), which is the normal case if the RP and the new assembly area are properly selected, this time factor will be the time to complete the move from IP to RP. Any consideration of time consumed in moving by motor from the RP to the DP in the new area is included in the time factors given in (g) below. If the distance is over 3 miles from RP to DP, the time to traverse this distance must be added to the time required to complete the move from the IP to the RP before considering the time factor for detrucking troops in (f) below.

(f) Detruck, reform foot troops.....	5 min.	10 min.
(g) Organization and movement in the new assembly area prior to troops reaching the foot IPs for the foot march to the line of departure. (This includes movement from the RP as outlined in (e) above as well as time to issue any additional rations or am- munition carried in each truck trans- porting troops.).....	30 min.	60 min.
(h) Time to move from foot IPs in the new area to line of departure. (Time distance of foot march.).....	See par. 54d(1).	
(i) Time for final preparation after the leading man reaches the line of depar- ture and prior to launching a coordi- nated attack. (This factor includes time to close foot troops behind the line of departure, time to reconnoiter, issue orders in subordinate units, and emplace and register infantry weapons where necessary.).....	60 min.	90 min.

Table of Road Spaces and Time Lengths—Armored Division

Example:

1	2	3	4	5	6	7	8	9	10	11	12
Unit	Actual strength							Road space ¹ (miles)		Time length ¹ (minutes)	
	Off and EM	Organic veh	Recon party	Dispersed along route	Veh in adv party	Veh in fld tn	Veh in march col	Veh in march colm (col 8)		Veh in march colm (col 8)	
								Close col 75 veh/mi 10 MPH	Open col 20 veh/mi 15 MPH	Close col 75 veh/mi 10 MPH	Open col 20 veh/mi 15 MPH
Armd Div.....	16,053	3,269	204	56	94	702	2,213	44.3	133	266	512
Div Trp.....	929	215	-----	56	31	15	113	2.2	7	14	28
Hq & Hq Co, Armd Div ¹	367	54	-----	-----	7	3	44	1	3	5	11
Armd Sig Co.....	374	94	-----	-----	17	12	65	1.3	4	8	18
MP Co.....	188	67	-----	56	7	-----	4	.1	.2	1	1
3 MP Traf Plat (each).....	34	15	-----	15	-----	-----	-----	-----	-----	-----	-----
2 Hq & Hq Co, CC (each).....	113	28	-----	-----	2	1	25	.5	1.5	3	6
Hq & Hq Co Res Comd.....	113	28	-----	-----	2	1	25	.5	1.5	3	6
CC ¹	3,412	647	40	-----	13	40	554	11.3	34	68	136
Hq & Hq Co, CC.....	113	28	-----	-----	2	1	25	.5	1.5	3	6
Armd Inf Bn ²	1,074	142	-----	-----	2	13	127	2.4	8	15	30
M Tk Bn ²	761	172	-----	-----	2	11	159	3.2	0.5	19	38
Tk Co (Hv).....	149	32	-----	-----	-----	1	31	.6	2	4	8
Armd FA Bn, 105-mm.....	684	148	-----	-----	6	12	130	2.7	8.0	16	32
Btry AAA, AW.....	154	26	-----	-----	1	1	24	.5	1.5	3	6
Recon Co.....	163	40	40	-----	-----	-----	-----	-----	-----	-----	-----
Armd Engr Co.....	184	29	-----	-----	-----	1	28	.6	2	4	7
Armd Med Co.....	115	24	-----	-----	-----	-----	24	.5	1.5	3	6

RESTRICTED

20	Armd Ord Maint Contact Party.....	15	6				6	.2	.5	1	2
21	Recon Bn 1 st	834	200	200				4.0	12	24	48
22	Hq & Hq & Svc Co 1 st	154	40	40				(colm 4) .9	(colm 4) 2.5	(colm 4) 5	(colm 4) 10
23	4 Recon Co (each).....	163	40	40				(colm 4) .9	(colm 4) 2.5	(colm 4) 5	(colm 4) 10
								(colm 4)	(colm 4)	(colm 4)	(colm 4)
24	Armd Engr Bn 1 st	1,100	239	4		1	15	219	4.2	13	26
25	Hq & Hq & Svc Co.....	214	62	4		1	11	46	1	3	6
26	Brg Co.....	124	01					61	1.3	4	8
27	2 Brg Plat (each).....	37	25					25	.5	1.5	3
28	4 Engr Co (each).....	184	29				1	28	.6	2	4
29	Tk Bn (Hv) 1 st	680	167			2	11	154	3.1	9.5	19
30	Hq & Hq & Svc Co.....	214	71			2	8	61	1.3	4	8
31	3 Tk Co (Hv) (each).....	140	32				1	31	.6	2	4
32	4 Armd Inf Bn 1 st (each).....	1,074	142			2	13	127	2.5	8	15
33	Hq & Hq & Svc Co.....	200	50			2	9	39	1	2.5	5
34	4 Rifle Co (each).....	209	23				1	22	.3	1.4	3
35	3 M Tk Bn 1 st	761	172			2	11	159	3.2	9.5	19
36	Hq & Hq & Svc Co.....	268	80			2	7	71	1.4	4.3	9
37	4 M Tk Co (each).....	118	23				1	22	.3	1.4	3
38	Div Arty 1 st	3,764	761			31	68	667	13.4	40	80
39	Hq & Hq Btry.....	180	37			2	4	31	.7	2	4
40	3 Armd FA Bn, 105-mm How (each).....	684	148			0	12	130	2.7	8.0	16
41	Hq & Hq Btry.....	170	38			2	3	33	.7	2	4
42	3 Armd FA Btry (each).....	136	26			1	1	24	.5	1.5	3
43	Svc Btry.....	106	32			1	6	25	.5	1.5	3
44	Armd FA Bn, 155-mm How (each).....	692	140			6	12	122	2.4	7.5	15
45	Hq & Hq Btry.....	139	30			2	3	25	.5	1.5	3
46	3 Armd FA Btry (each).....	149	26			1	1	24	.5	1.5	3
47	Svc Btry.....	106	32			1	6	25	.5	1.5	3

See footnotes at end of table.

RESTRICTED—Security Information

Table of Road Space and Time Lengths—Armored Division—Continued

	1	2	3	4	5	6	7	8	9	10	11	12
1	Unit	Actual strength							Road space ¹ (miles)		Time length ¹ (minutes)	
		Off and EM	Organic veh	Recon party	Dispersed along route	Veh in adv party	Veh in fld tn	Veh in march coln	Veh in march coln (coln 8)		Veh in march coln (coln 8)	
									Close coln 75 veh/mi 10 MPH	Open coln 20 veh/mi 15 MPH	Close coln 75 veh/mi 10 MPH	Open coln 20 veh/mi 15 MPH
	Div Arty—Continued											
48	AAA AW Bn.....	778	140	-----	-----	5	11	124	2.4	7.5	15	30
49	Hq & Hq Btry.....	162	36	-----	-----	1	8	27	.6	1.7	4	7
50	4 Btry AAA AW (each).....	154	26	-----	-----	1	1	24	.5	1.5	3	6
51	Armd Div Tn ²	1,828	519	-----	-----	9	510	-----	-----	-----	-----	-----
52	Hq & Hq Co.....	100	37	-----	-----	2	35	-----	-----	-----	-----	-----
53	Armd Div Band.....	70	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
54	Repl Co.....	41	4	-----	-----	1	3	-----	-----	-----	-----	-----
55	QM Bn ²	423	142	-----	-----	2	140	-----	-----	-----	-----	-----
56	Hq & Hq Det.....	56	7	-----	-----	2	5	-----	-----	-----	-----	-----
57	Sup Co.....	189	65	-----	-----	-----	65	-----	-----	-----	-----	-----
58	Fld Svc Co.....	171	70	-----	-----	-----	70	-----	-----	-----	-----	-----
59	Armd Ord Maint Bn ²	737	236	-----	-----	2	234	-----	-----	-----	-----	-----
60	Hq & Hq Co.....	192	65	-----	-----	2	63	-----	-----	-----	-----	-----
61	3 Armd Ord Maint Co (each).....	179	57	-----	-----	-----	57	-----	-----	-----	-----	-----
62	Ord Contact Party.....	15	6	-----	-----	-----	-----	-----	-----	-----	-----	-----
63	Armd Med Bn.....	457	100	-----	-----	2	98	-----	-----	-----	-----	-----
64	Hq & Hq Co.....	112	28	-----	-----	2	26	-----	-----	-----	-----	-----
65	3 Armd Med Co (each).....	115	24	-----	-----	-----	24	-----	-----	-----	-----	-----
66	Amb Plat.....	25	11	-----	-----	-----	11	-----	-----	-----	-----	-----
67	Litter Plat.....	30	2	-----	-----	-----	2	-----	-----	-----	-----	-----
68	Clearing Plat.....	33	6	-----	-----	-----	6	-----	-----	-----	-----	-----

69	Fld Tn (unit).....							192	3.8	11.5	23	40
70	Div Tn.....							510	10.2	30.6	62	123

¹ Includes med det.

² Includes road space and time interval between march units but not between serials.

³ CC organized tactically. There is no fixed tac orgn for a CC and this orgn is purely arbitrary.

⁴ Admin marches only.

k. Average Time Factors—Armored Division.

- (1) This table pertains to G3 time factors considered after an armored division receives a movement order. It gives the times required by the command for—
 - (a) Making preparations before the leading vehicle can arrive at the initial point (IP).
 - (b) Completing the motor march and making preparations to launch a coordinated attack.
- (2) The preparations before the leading vehicle can arrive at the IP are less time consuming than in the infantry division as the armored division is able to move the entire division by organic vehicles. Preparations include transmission of orders by division, briefing of troops, and other normal preparations for an anticipated move. It is standing operating procedure (SOP) for armored division vehicles to be refueled and expended ammunition replaced at once whenever a halt is made or any element of the division enters an assembly area or attack position, thus permitting vehicles to move as soon as personnel and equipment are loaded.
 - (a) If the order were received in daylight for a daylight march, for example, received at 1000, leading vehicle can cross IP at 1045----- $\frac{3}{4}$ hr.
 - (b) If the order were received at night for a night march, for example, received at 2200, leading vehicle can cross the IP at 2300----- 1 hr.
 - (c) If the order were received in daylight for a night march, for example, received at 1100, leading vehicle can cross IP 30 minutes after EENT—30 min after EENT. (For EENT see par. 46f.)
 - (d) If the order were received at night for a daylight march, and more than 1 hour prior to BMNT, for example, received at 0200 hr, leading vehicle can cross IP at BMNT—BMNT (See par. 46f (1).) (If order were received less than 1 hr. prior to BMNT, the time is the time the order was received plus 1 hr.).
- (3) The factors considered in computing time for an armored division to complete a march and make preparations for launching a coordinated attack are dependent upon whether the armored division is organized for combat or not. Generally, it is assumed, unless otherwise stated, that the division is organized for combat in anticipation of the move and commitment to battle. The time factors (b) and (c) apply to any move and are based on the assumption that the division can launch a coordinated attack when two reinforced

battalions (equivalent of one infantry battalion and one tank battalion) of each combat command are in position to attack. If the division formation is a column of combat commands, only the time factors for the leading combat command are computed. If the division formation is combat commands abreast, the time factors for the combat command with the greatest distance to traverse are computed as the factors for the entire division. If an armored division is not organized for combat, time must be allowed (as indicated in (a) below), to permit battalions and supporting units to assemble under a combat command and organize into reinforced battalions under the combat command commander. Other commands, such as the reserve command, division troops, division artillery, division trains, and units placed in division troops, can be assumed to complete their organization in less time than a combat command and therefore are not included as a factor. The organization of combat commands and reinforced battalions may be partially or entirely completed either in bivouac, assembly area or attack position or a combination thereof. The time factor, however, remains the same.

	<i>Day</i>	<i>Night</i>
(a) Organize combat commands and reinforced battalions. (In either one or combination of bivouac, assembly area and attack position, and attack position).	45 min.	1 hr. 30 min.
(b) Complete march from old area to new area.	See (3) above	
(c) Time for final reconnaissance, refueling, and preparations to cross the line of departure or leave attack position (may be a combined assembly area-attack position).	30 min.	1 hr.

l. Motor Movement by Echelon.

- (1) *Definition.* Motor movement by echelon is a movement in which a unit, such as an infantry division, lacking sufficient organic transportation to move all its personnel and equipment in one trip, uses a portion of its transportation to move its foot troops and essential supplies (by complete tactical units) in successive trips until the movement of all has been completed.

RESTRICTED—Security Information

- (2) *Time formula.* The following formula is useful for determining the total time of such a movement:

$$\text{Hours required} = \frac{[\text{Number of trips} \times \text{distance in miles}]}{\text{Rate of march in miles per hour}} + T$$

- (a) The "number of trips" is the number of trips in either direction; for example, in a two-echelon movement, three trips would be required—one forward trip to move foot troops, a return trip, and a second trip forward for the remainder of troops and organic loads.
 - (b) *T* (a variable) represents the number of hours consumed in unloading and loading personnel and equipment, in turn-arounds at forward and rear assembly areas, and in closing the column into its area of destination. When two routes are available and the movement is made in close column in two echelons, a value of six may be assumed for *T*, as giving a reasonable factor of safety. When more than two routes are available, the value of *T* may be reduced.
 - (c) Rate of march in miles per hour represents the average speed of the vehicles in the movement, over a period of time, including short halts.
- m. Motor Movement by Echelon—Infantry Division.*
- (1) Refer to *l* above for general formula for movement by echelon, and to *a*(1) and *b* above and *c* below for transportation requirements and availability.
 - (2) The following example of standing operating procedure for a motor movement by echelon for an infantry division should be used only as a guide from which to prepare plans based upon the actual transportation available and the personnel to be moved.
 - (3) *Motor movement 1.*

- (a) *Plan.* Motor movement 1 is a movement in which the division moves in its organic motors in two echelons behind a screen furnished by troops outside the division adequate to protect the movement against strong frontal attack. Combat teams 1 and 2 constitute the first echelon. It moves on one or more routes and protects its immediate front with small advance guards. In addition to its organic transportation, sufficient additional trucks from units of the division not moving in the first echelon are attached to

Combat teams 1 and 2 for the movement to transport by motor all their personnel and equipment. At the conclusion of the movement of the first echelon, trucks belonging to units of the second echelon return to pick up basic loads and move Combat team 3. Necessary trucks from units of the first echelon dump loads in the forward area and return to assist in moving foot troops of the second echelon. Division troops and division trains (less field trains) move in the second echelon. Field trains move with their parent unit.

- (b) *Security.* The reconnaissance company protects the movement by conducting reconnaissance to the front and flanks.
- (c) *Warning order.* Preliminary arrangements for the movement will be inaugurated upon receipt of order "Alert for Motor Movement 1," or "Alert for Motor Movement 1 after designated hour."

MOTOR MOVEMENT 1 (MM1)—1ST INFANTRY DIVISION

First Echelon <i>Serial 1</i>		Second Echelon <i>Serial 3</i>	
CT1:		CT3:	
1st Inf		3d Inf	
1st FA Bn		3d FA Bn	
Co A 1st Engr C Bn		Co C 1st Engr C Bn	
Btry A 1st AAA		Btry C 1st AAA	
AW Bn SP.		AW Bn SP.	
Det Sig Co		Det Sig Co	
Det Ord Bn		Det Ord Bn	
<i>Serial 2</i>		<i>Serial 4</i>	
CT2:		Div Trs:	
2d Inf		1st Inf Div Arty (-)	
2d FA Bn		1st Engr C Bn (-)	
Co B 1st Engr C Bn		1st Med Bn	
Btry B 1st AAA AW Bn SP		1st Inf Div Hq & Hq Co (-)	
Det Sig Co		1st MP Co (-)	
Det Ord Bn		1st Sig Co (-)	
		1st Tk Bn	
		<i>Serial 5</i>	
		Div Tns:	
		Rr Ech Div Hq & Hq Co	
		Det Sig Co	
		Det MP Co	
		1st QM Co	
		1st Ord Bn (-)	
		Repl Co	

RESTRICTED—Security Information**MOTOR MOVEMENT 1 (MM1)—1ST INFANTRY DIVISION MOVEMENT OF FOOT TROOPS (MM1)**

	1	2	3	4
	Unit from which transport is furnished	Number of 2½-ton trucks provided and unit to which furnished ¹		
		1st Echelon		2d Echelon
		1st Infantry	2d Infantry	3d Infantry
1	CT 1:			
2	1st Inf.....			32
3	1st FA Bn.....			10
4	CT 2:			
5	2d Inf.....			35
6	2d FA Bn.....			10
7	CT 3:			
8	3d Inf.....	25		
9	3d FA Bn.....	10		
10	Div Trs and Div Tns:			
11	QM Co.....		49	
12	Sig Co.....		10	
13	Ord Bn.....	10		
14	AAA AW Bn SP (-).....		12	
15	Tk Bn.....	22		
	Engr Bn (-).....	20		
	4th FA Bn.....		16	
	Total ²	87	87	87

¹ See n below for availability of trucks for troop movement.

² Total number of trucks required is based on—

Total troops on foot in each infantry regiment—2,182.

Passenger capacity of trucks: 2½ ton—25.

(4) Motor movement 2.

(a) *Plan.* Motor movement 2 is a movement in which the division moves in its organic motors in two echelons. Combat teams 1, 2, and 3, less one infantry battalion each, move in the first echelon. The infantry battalion from each combat team and the remainder of the troops of the division move in the second echelon. Each combat team dumps basic loads from trucks that can be diverted temporarily from their normal functions to assist in moving some of their own foot troops. Additional trucks to move the remaining foot troops of the first echelon are furnished by units moving in the second echelon. At the conclusion of the movement of the first echelon, trucks which carried foot troops return to pick up their basic loads. Necessary trucks from each combat team that moved forward in the first echelon with their basic loads, dump their loads in the forward area and return to assist in moving the infantry

battalion of their respective combat teams. Field trains move with their parent unit.

- (b) *Security.* The reconnaissance company protects the movement by conducting reconnaissance to the front and flanks.
- (c) *Warning order.* Preliminary arrangements for this movement will be inaugurated upon receipt of order "Alert for Motor Movement 2" or "Alert for Motor Movement 2 after (designated hr)."

MOTOR MOVEMENT 2 (MM2)—1st INFANTRY DIVISION

First Echelon

CT 1:	CT 2:	CT 3:
1st Inf (less 1 Bn)	2d Inf (less 1 Bn)	3d Inf (less 1 Bn)
1st FA Bn	2d FA Bn	3d FA Bn
Co A 1st Engr C Bn	Co B 1st Engr C Bn	Co C 1st Engr C Bn
Btry A 1st AAA AW Bn SP.	Btry B 1st AAA AW Bn SP.	Btry C 1st AAA AW Bn SP.
Det Sig Co	Det Sig Co	Det Sig Co
Det Ord Bn	Det Ord Bn	Det Ord Bn

Second Echelon

1 Bn, 1st Inf	1 Bn, 2d Inf	1 Bn, 3d Inf
Div Trs:		
1st Inf Div Arty (-); 1st Engr C Bn (-); 1st Med Bn; 1st MP Co (-); 1st Sig Co (-); 1st Inf Div Hq & Hq Co (-); 1st Tk Bn.		
Div Tns:		
Rr Ech Div Hq & Hq Co; Det Sig Co; Det MP Co; 1st QM Co; 1st Ord Bn (-) Repl Co.		

ASSIGNMENT OF MOTOR TRANSPORT FOR MOVEMENT OF FOOT TROOPS (MM 2)

	1	2	3	4	5	6	7
		Number of 2½-ton trucks and unit to which furnished					
1	Unit from which transport is furnished	1st Echelon			2d Echelon		
		1st Inf (-)	2d Inf (-)	3d Inf (-)	1st Inf (1 Bn)	2d Inf (1 Bn)	3d Inf (1 Bn)
2	CTs:						
3	Inf Regts, each.....	10	10	10	20	20	20
4	FA Bns, each.....	6	6	6	8	8	8
5	Div Trs and Div Tns:						
6	QM Co.....	25		24			
7	Sig Co.....	9					
8	Ord Bn.....	9					
9	4th FA Bn.....		13				
10	Engr Bn (-).....			19			
11	Tk Bn.....		20				
12	AAA AW Bn (-).....		10				
13	Total*.....	59	59	59	28	28	28

*Total number of trucks required is based on total troops on foot in each infantry regiment, 2,132, each infantry battalion, 682.

RESTRICTED—Security Information

n. Example of Work Sheet Showing Availability of Cargo Trucks (2½-ton) in the Infantry Division for Movement of Foot Troops. The following table shows a priority which might be established within a division for the availability of organic motor transportation to be used for movement of foot troops by echelon. The table also can be used in determining the priority of transport to be used in motorizing an infantry unit in reserve, or for cargo hauling.

WORK SHEET—AVAILABILITY OF MOTOR TRANSPORT FOR TROOP MOVEMENTS^{1 2 3}

	1	2	3	4	5	6	7	8	9	10	11
1	Normal use (Priority in order given)	3 Inf Rgts (each)	3 FA Bns 105-mm How (each)	FA Bn 155-mm How	AAA AW Bn SP (40-mm)	Engr C Bn	Hv Tk Bn	QM Co	Ord Bn	Sig Co	Total
2	Orgn Equip.....	5			5	6	3	3	4	6	42
3	Sup & Gen Cargo.....	7	1	1	6	12	15	48	6		112
4	K1 Trks.....	20	5	5	5	5	4	1	2	2	99
5	Engr tools.....					49					49
6	Am & AT mines.....	16	11	9	8	2	14				114
7	Comd & Opns.....		2	3	1				2		12
8	Sig Com.....	1	2	3	5	1				7	25
9	Med.....	4			1	1					14
10	Total.....	53	21	21	431	76	36	52	14	15	467

¹ The availability of trucks and priority of such availability are command decisions.

² Prime movers omitted. See FM 100-5.

³ Motor maintenance and service vehicles omitted.

⁴ Each AAA AW Btry SP has two trucks, 2½-ton (excluding 2½-ton Mtr Maint Trk.)

⁵ Each Engr C Co has 14 trucks, 2½-ton.

56. Movement by Air

a. General.

- (1) The tables in this paragraph are to be used as a guide to determine the aircraft requirements, by type of transport aircraft, for air movement of units of the type field army. For the aircraft requirements for air movement of airborne and infantry divisions or their organic units, see FM 57-30. The following tables are based on data compiled for a theoretical situation which assumes full T/O & E strength and complete T/O & E equipment. In applying these tables to actual air movements, bear in mind that the required lift for any unit will fluctuate with the personnel and equipment status of that unit. The tables show numbers of aircraft loads; i. e., the number of sorties, by type of aircraft, required to move a particular unit. Therefore, fewer aircraft than shown may be used to transport the unit if part or all of the aircraft fly more than one sortie.

- (2) The air movement of a large body of troops normally will involve concurrent departures from several airfields and, in air-landed operations, concurrent landing at several terminal airfields, airstrips, or landing zones in the objective area. The availability of transport aircraft, air installations, and base facilities, the urgency of the situation, and enemy capabilities will be major factors which will determine the number of installations employed as well as the number of sorties to be flown by the transporting aircraft. For considerations governing the employment of air transportation, see FM 100-5 and FM 57-30. For staff procedures, air movement tables, and other forms relative to air movement, see FM 57-30, FM 101-5, and TM 57-210.

b. Aircraft Requirements—Army.

- (1) *General.* The tabulated data in (4) (a), (b) and (c) below represent aircraft requirements for units of a type field army. The data are applicable in planning for airborne operations or the administrative air movement of units of the type field army.

(2) *Equipment and supplies.*

- (a) Column 3 of these tables indicates the total weight of each unit in short tons. This figure is the sum of the weights of T/O & E personnel and equipment, Classes I and III supply for 3 days, and prescribed loads of Class V supply. The prescribed loads of Class V supply may be the same, more, or less than the basic loads of Class V, since they are determined separately for each specific airborne operation. Normally, the prescribed loads of Class V supply represent 3 days of supply for the specific operation being considered.

- (b) *T/O & E personnel and equipment.* Unless otherwise indicated, all units are moved at 100 percent personnel and equipment strength. An average weight of 240 pounds per individual is used in determining total personnel weight for a unit. Weights of vehicles are determined by use of net weights given in TM 9-2800, or applicable Technical Manuals.

- (c) *Supply.* The major classes of supply considered are Classes I, III, and V. The accompanying Classes II and IV supply are limited to critical items and are usually in such small amounts that their weights are incidental and therefore are not included.

1. Class I supply is based on 3 days to accompany each unit with an average weight of 17 pounds per man per day.

RESTRICTED—Security Information

2. Class III supply is based on the weight of gasoline, oil, and lubricants required to operate vehicles a minimum of 300 miles. Class III requirements for other self-propelled equipment and for fuel-consuming machinery are established on a reasonable hourly operational basis for three days.

3. Class V supply weights are based on the basic load for all units adjusted to a reasonable rate of consumption so as to reflect three days of Class V supply. The weights of Class V supply for some army units have not been included. They are too small to be significant because the greater part is carried by the individual.

(3) *Aircraft requirements.*

(a) Aircraft requirements listed in (4)(a), (b), and (c) below reflect the number of sorties required to transport the various units.

(b) The aircraft requirements are based on the following assumed allowable cargo loads.

<i>Type aircraft</i>	<i>Allowable cargo load (pounds)</i>
C-119, medium transport airplane.....	16, 000
C-123, medium assault airplane.....	16, 000
C-124, heavy transport airplane.....	50, 000

(c) The same allowable cargo load is used for the C-119 and C-123 to facilitate interchanging of loads for planning purposes on a one for one basis. As a result, aircraft are considered in two general groups, medium and heavy.

(d) Air Force troop carrier units, providing aircraft for the specific operation being considered, will announce to the Army component of the airborne force the allowable cargo load for each type aircraft that will be employed, because the allowable cargo load will vary with the distance to be flown and other operational conditions.

(e) In any airborne operation it may be necessary to use types of aircraft other than those listed. However, the data given will serve as a basis for adaptation of the units to be moved to the types of aircraft that are available.

(f) Two loading methods are indicated in column 4.

1. The first load method indicates the aircraft requirements for a given unit when the maximum number of medium aircraft are used. In the event the unit contains heavy or bulky items transportable only in heavy aircraft, the figure in column 6 indicates the minimum number of heavy aircraft required.

2. The second load method indicates the aircraft requirements when the entire unit is transported in heavy airplanes. If a unit contains equipment not transportable by this class airplane, movement by other means of transportation is required. If accomplishment of the primary mission of the unit is dependent upon the availability of such heavy equipment, it may be necessary to substitute lighter items which are capable of performing similar missions. The heavy tank battalion is an example of a unit with heavy equipment which is nontransportable by heavy transport airplanes.
3. Units in which the first load method has been omitted are those having quantities of heavy or bulky equipment that preclude efficient loading in medium assault or medium transport aircraft.

(g) In selection of a load method by which to transport a unit, careful consideration must be given to the primary mission of the unit and the requirement for the unit in the airhead. During the initial airborne assault, units transported to the objective area will utilize a combination of parachute and medium assault aircraft. Subsequent to the initial assault and after landing fields have been prepared, medium transport aircraft may be used. When airfields are developed sufficiently to handle heavy transport airplanes, units requiring this means of transportation can be phased into the airhead.

(4) *Tabulated requirements—Army.*

(a) *Headquarters and divisions.*

1	2	3	4	5	6	7	8
Unit	T/O & E	Total weight unit in short tons	Load method	Aircraft requirements		Unused allowable cargo load in short tons	Remarks
				C-123, C-119	C-124		
Hq & Hq Co, Army.....	51-1-2	277	1	35	-----	3	
			2	-----	12	23	
Hq, Spl Trp, Army.....	51-3	16	1	2	-----	-----	
			2	-----	1	9	
Hq & Hq Co, Corps.....	52-1-2	167	1	21	-----	1	
			2	-----	7	8	
Airborne Div.....	-----	-----	-----	-----	-----	-----	See FM 57-30.
Infantry Div.....	-----	-----	-----	-----	-----	-----	See FM 57-30.

(b) Branches.

1	2	3	4	5	6	7	8
Unit	T/O & E	Total weight unit in short tons	Load method	Aircraft requirements		Unused allowable cargo load in short tons	Remarks
				C-123, C-119	C-124		
Armored:							
Armd Cav Regt(L)...	17-51	5508	1 2	165	168 221	12 17	{ Light tanks substituted for medium tanks.
Hq & Hq Co Armd Cav Gp.	17-32	125	1 2	7	3 5	6	
Tk Bn (Heavy). ----	17-35	2452	1 2	41	87 99	51 23	{ Light tanks substituted for heavy tanks.
Army Security Agency Units:							
Hq & Hq Co Comm Recon Gp.	32-500	99	1 2	11	1 4	14 1	Not transportable in medium aircraft without major disassembly of major items.
Hq & Hq Det Comm Recon Bn.	32-500	29	1 2	4	2	3 21	
Comm Recon Co (Intel).	32-500	502	1 2	60	1 21	3 23	
Comm Recon Co (Scty).	32-500	224	1 2	25	1 9	1 1	
Artillery:							
Hq & Hq Btry, Corps Arty.	6-501	229	1 2	29	----- 10	4 21	
Hq & Hq Btry, FA Gp.	6-401	138	1 2	18	----- 6	6 12	
FA Obsn Bn. -----	6-575	1,209	1 2	105	15 49	6 16	
FA Searchlight Btry	6-558A	145	1 2	----- -----	----- 8	----- 55	
Hq & Hq Btry AAA Brig.	44-101A	91	1 2	12	----- 4	5 9	
Hq & Hq Btry AAA Gp.	44-12A	75	1 2	7	1 3	6 -----	
AAA Opns Det. ----	44-7	60	1 2	8	----- 3	4 15	
AA AW Bn, Mbl.---	44-25	1,140	1 2	140	1 46	5 10	
AAA AW Bn, SP...	44-75	1,485	1 2	49	44 60	7 15	
AAA Gun Bn, 90 mm.	44-15A	1,416	1 2	84	30 57	6 9	
AAA Bn L, 75-mm Mbl.	44-35	1,324 (estimated)	1 2	56	35 53	24 1	
FA Bn, 4.5-in Rocket.	6-615	797	1 2	97	1 32	4 3	
FA Bn, 105-mm How SP, Armd.	6-315	1,537	1 2	49	46 62	5 13	
FA Bn, 155-mm How Towed.	6-135	868	1 2	81	10 35	30 7	
							Veh Tk recovery not air transportable.

(b) Branches—Continued

1	2	3	4	5	6	7	8
Unit	T/O & E	Total weight unit in short tons	Load method	Aircraft requirements		Unused allowable cargo load in short tons	Remarks
				C-123, C-119	C-124		
Artillery—Continued							
FA Bn, 155-mm How SP, Armd.	6-325	1,746	1 2	50	54 70	4 4	Veh Tk recovery not air transportable.
FA Bn, Towed, Hv 155-mm Gun.	6-415	1,279	1 2	23	44 52	5 21	
FA Bn, Hv, SP, 155-mm Gun.	6-435		1 2				Not air transportable.
FA Bn, Hv, Towed, 8-in. How.	6-415	1,327	1 2	29	44 54	5 23	
FA Bn, Hv, SP, 8-in. How.	6-435		1 2				Not air transportable.
FA Bn, VH, Towed 240-mm How.	6-515	1,446	1 2	84	31 58	1 4	Tractor M8 substituted for tractor M5. Crane M2, tractor M5 and vehicle tank recovery not air transportable. Weight shown in Col 3 is weight of unit and equipment that is air transportable.
FA Bn, VH, Towed 8-in. Gun.	6-515	1,425	1 2	82	31 57	6	Tractor M8 substituted for tractor M6. Crane M2, tractor M5 and vehicle tank recovery not air transportable. Weight shown in Col. 3 is weight of unit and equipment that is air transportable.
FA Bn, 280-mm Gun.	6-535						Data not available.
Arty Rocket Btry...	6-538						Data not available.
Guided Missiles Bn SSM.	6-545						Data not available.
Guided Missiles Bn SAM.	44-145						Data not available.
Chemical:							
Hq & Hq Co, Cml Gp (Fld).	3-32	40	1 2	5			
Hq & Hq Det, Cml Smoke Genr Bn.	3-266	24	1 2	3			
Cml Smoke Genr Co.	3-267	316	1 2	40			
Hq & Hq Co, Cml Bn (Svc).	3-35	10	1 2	2			
Cml Maint Co.....	3-47	108	1 2	8			

(b) Branches—Continued

1	2	3	4	5	6	7	8
Unit	T/O & E	Total weight unit in short tons	Load method	Aircraft requirements		Unused allowable cargo load in short tons	Remarks
				C-123, C-119	C-124		
Chemical—Continued							
Cml Depot Co.....	3-67	147	1	9	3		
			2		6	3	
Cml Decon Co.....	3-217	156	1	20		4	
			2		7	19	
Cml Svc Dets:							
Det IB, Tech Svc	3-500	14	1	2		2	
Intel.			2		1	11	
Engineer:							
Engr Cam Bn, Army.	5-95	365	1	46		3	
			2		15	10	
Hq & Hq Co, Engr	5-192A	96	1	19		56	
C Gp.			2		4	4	
Engr C Bn, Army...	5-35	882	1	75	17	143	
			2		36	18	
Hq & Hq Co, Engr	5-312	70	1	10		10	
Const Gp.			2		3	5	
Engr Const Bn.....	5-315	1,785	1	73	50	49	
			2		72	15	
Engr Dp Trk Co.....	5-324	516	1	62	1	5	
			2		21	9	
Engr Hv Equip Co..	5-328	1,274	1	38	39	5	
			2		51	1	
Engr L Equip Co....	5-367	1,369	1	37	43	2	
			2		55	6	
Engr Fltg Brg Co....	5-138	814	1	40	20	6	
			2		33	11	
Engr Pnl Brg Co.....	5-137	544	1	53	5	5	
			2		22	6	
Engr Pon Brg Co....	5-139	1,473	1	150	11	2	
			2		59	2	
Engr Aerial Photo	5-54	301	1				Not air transportable in medium aircraft.
Repro Co.			2		15	74	
Engr Topo Bn, Army.	5-55	412	1	34	9	85	
			2		17	13	
Engr Topo Co, Corps.	5-167	172	1	15	3	23	
			2		7	8	
Engr Maint & Sup	5-262	150	1	19		2	
Gp.			2		6		
Hq & Hq Det, Engr	5-266	38	1	6		10	
Dep Bn.			2		2	12	
Engr Dep Co.....	5-267A	365	1	21	10	3	
			2		15	10	
Engr Sup Pt Co.....	5-48	178	1	10	4	2	
			2		8	22	
Engr Fld Maint Co..	5-157A	284	1	14	9	53	
			2		12	16	
Engr WS Co.....	5-67A	221	1	30		19	
			2		9	4	
Platoon, Fire Fighting.	5-500	35	1	5		5	
			2		2	15	

(b) Branches—Continued

1	2	3	4	5	6	7	8
Unit	T/O & E	Total weight unit in short tons	Load method	Aircraft requirements		Unused allow-able cargo load in short tons	Remarks
				C-123, C-119	C-124		
Engineer—Continued							
Det, Spl Equip	5-500ED	133	1	11	2	5	
Maint.			2		6	17	
Engr Tech Intel	5-398T	7	1	1		1	
Team (C).			2		1	18	
Engr Tech Intel	5-399T	12	1	2		4	
Team (R).			2		1	13	
Infantry:							
Inf Hq Mort Bn.....	7-45	596	1	75		4	
			2		24	4	
Inf Regt (Sep).....	7-11	2, 270	1	244	22	232	
			2		91	5	
Medical:							
Hq & Hq Det, Med	8-22	27	1	4		5	
Gp.			2		2	23	
Hq & Hq Det, Med	8-26	27	1	4		5	
Bn (Sep).			2		2	23	
Med Coll Co (Sep)...	8-27	83	1	11		5	
			2		4	17	
Med Clr Co (Sep)....	8-28	69	1	10		11	
			2		3	6	
Med Holding Co.....	8-57	72	1	9			
			2		3	3	
Med Amb Co (Sep)...	8-317	192	1	24			
			2		8	8	
Preventive Med Co...	8-117	112	1	14			
			2		5	13	
Med Fld Lab, Army.	8-640	57	1	8		7	
			2		3	18	
Army Med Depot.....	8-667	241	1	27	1		
			2		10	9	
Mbl Army Surg Hosp.	8-571	95	1	12		1	
			2		5	30	
Shock Det.....	8-500KC	7	1	1		1	
			2		1	18	
Maxillo-Facial Det...	8-500KD	7	1	1		1	
			2		1	18	
Neurosurgical Det...	8-500KE	7	1	1		1	
			2		1	18	
Thoracic Det.....	8-500KF	7	1	1		1	
			2		1	18	
Gas Det.....	8-500KG	20	1	3		4	
			2		1	5	
Dental Svc Det.....	8-500KJ	40	1	3	1	9	
			2		2	10	
Dental Prosthetic	8-500KK	11	1	1	1	22	
Det (Mbl).			2		2	39	
Psychiatric Det.....	8-500KO	18	1	3		6	
			2		1	7	
Gen Dispensary.....	8-500MA	15	1	2		1	
			2		1	10	
Med Det.....	8-500OA	11	1	2		5	
			2		1	14	

RESTRICTED—Security Information

(b) Branches—Continued

1	2	3	4	5	6	7	8
Unit	T/O & E	Total weight unit in short tons	Load method	Aircraft requirements		Unused allowable cargo load in short tons	Remarks
				C-123, C-119	C-124		
Medical—Continued							
Evac Hosp, SmbI (400 bed).	8-581	300	1	40		20	
			2		12		
Evac Hosp (750 bed)...	8-580	333	1	44		19	
			2		14	17	
Convalescent Center, Army.	8-590	329	1	42		7	
			2		14	21	
Hq, Professional Svc.	8-500AG	11	1	2		5	
			2		1	14	
Optical Det.....	8-500GA	8	1	1			
			2		1	17	
Optical Det.....	8-500GB	4	1	1		4	
			2		1	21	
Vet Food Insp Det...	8-500JA	8	1	1			
			2		1	17	
Surgical Det.....	8-500KA	5	1	1		3	
			2		1	20	
Orthopedic Det.....	8-500KB	8	1	1			
			2		1	17	
Helicopter Amb Unit.	8-500RA	52	1	7		4	Does not include helicopters.
			2		3	23	
Food Service.....	29-500AF	4	1	1		4	
			2		1	21	
Automotive Maint...	29-500AL	4	1	1		4	
			2		1	21	
Military Police:							
MP Bn, Army.....	19-35	102	1	27		14	
			2		9	23	
MP Co, Corps and Army.	19-37	63	1	8		1	
			2		3	12	
Bn Hq & Hq Det (AD).	19-500	22	1	3		2	
			2		1	3	
MP Esct Gd Co (Mbl).	19-47	103	1	15		17	
			2		5	22	
MP Co (Gd) (Fxd)...	19-247	34	1	5		6	
			2		2	16	
CID (ME).....	19-500	27	1	4		5	
			2		2	23	
CID (MD).....	19-500	15	1	2		1	
			2		1	10	
Crimes Lab (Mbl) (MG).	19-500	13	1	2		3	
			2		1	12	
Ordnance:							
Hq & Hq Co, Ord Gp.	9-12	118	1	15		2	
			2		5	7	
Hq & Hq Det, Ord Bn.	9-76	53	1	7		3	
			2		3	22	
Ord Co, Direct Spt...	9-7A	574	1	35	12	6	
			2		23	1	
Ord Co, Direct Autmv Spt.	9-127A	457	1	33	8	7	
			2		19	18	
Ord Hv Maint Co (Army).	9-9	701	1	16	23	2	
			2		29	24	

(b) Branches—Continued

1	2	3	4	5	6	7	8
Unit	T/O & E	Total weight unit in short tons	Load method	Aircraft requirements		Unallowable cargo load in short tons	Remarks
				C-123, C-119	C-124		
Ordinance—Continued							
Ord HAM Co.....	9-197	530	1	4	20	2	
			2		22	20	
Ord Dep Co (Army)...	9-57	519	1	6	19	4	
			2		21	6	
Ord Recov Co.....	9-187	816	1	18	27	3	
			2		33	9	
Ord Rclm and Clas Co (Army)...	9-167	373	1	19	9	4	
			2		15	2	
Ord Arty & Veh Park Co.	9-137	251	1	26	2	7	
			2		11	24	
Ord Ammo Co (Army)...	9-17	222	1	25	1	3	
			2		9	3	
Ballistic & Tech Svc Det.	9-500FD	56	1	4	1	1	
			2		3	19	
EOD Sqd.....	9-500FA	24	1	1	1	9	
			2		2	26	
Tech Intel Det.....	9-500FE	8	1	1			
			2		1	17	
Integrated Fire Ctl Det.	9-500FH	26	1	1	1	7	
			2		2	24	
Ord SW Direct Spt Co.	9-49						Data not available.
Ord GM Direct Spt Co.	9-227						Data not available.
Quartermaster:							
Hq & Hq Co, QM Gp.	10-22	34	1	5		6	
			2		2	16	
Hq & Hq Det, QM Bn.	10-536	42	1	6		6	
			2		2	8	
QM Bkry Co (Mhl)...	10-147	217	1	21	2	1	
			2		9	8	
QM Clothing & Gen Sup Dep Co.	10-227	76	1	10		4	
			2		4	24	
QM Subs Dep Co....	10-357	77	1	10		3	
			2		4	23	
QM Ldry Co (Smbh)...	10-167	192	1	24			
			2		8	8	
QM Refrg Co (Mhl)...	10-247A	491	1	9	17	6	
			2		20	9	
QM Sales Co, Mbl....	10-157	172	1	22		4	
			2		7	3	
QM Svc Co.....	10-67	95	1	12		1	
			2		4	5	
QM Petrl Sup' Co (Mhl)...	10-77	297	1	35	1	8	
			2		12	3	
QM Bath Co (Smbh)...	10-257	65	1	9		7	
		(estimated)	2		3	10	
QM Gr Reg Co.....	10-297A	127	1	16		1	
			2		6	23	
QM Rclm & Maint Co (Smbh)...	10-237	96	1				Not transportable by medium aircraft.
			2		5	29	

(b) Branches—Continued

1	2	3	4	5	6	7	8
Unit	T/O & E	Total weight unit in short tons	Load method	Aircraft requirements		Unused allowable cargo load in short tons	Remarks
				C-123, C-119	C-124		
Quartermaster—Con.							
QM Salv Co.....	10-187	122	1	9	2		
			2		5	3	
QM Subs Sup Co....	10-197	110	1	14		2	
			2		5	15	
Signal Corps:							
Sig Bn Corps.....	11-15N	2,284	1	233	17	5	
			2		92	16	
Hq & Hq Co.....	11-16	166	1	15	2	4	
			2		7	9	
Rad & Msg Cen	11-17	384	1	45	1	1	
Opn Co.			2		16	16	
Tp & TT Opn Co.	11-18N	327	1	35	2	3	
			2		14	23	
Const Co.....	11-27N	469	1	22	12	7	
			2		19	6	
Hq & Hq Co, Sig	11-22	54	1	7	0	2	
Gp.			2		3	21	
Sig Const Bn.....	11-25	2,014	1	190	20	6	
			2		81	11	
Hq & Hq Co.....	11-26	138	1	6	4	10	
			2		6	12	
Const Co.....	11-27N	469	1	22	12	7	
			2		19	6	
Sig Bn (Opn).....	11-95A	1,655	1	157	16	1	
			2		67	20	
Hq & Hq Co.....	11-96A	127	1	13	1	2	
			2		6	23	
Co (Wire Opn).....	11-97A	481	1	36	8	7	
			2		20	19	
Co (Rad Opn).....	11-98A	667	1	72	4	9	
			2		27	8	
Co (Msg Cen Opn)...	11-99A	332	1	33	3	7	
			2		14	18	
Hq & Hq Co Sig Spt	11-116	72	1	9		0	
Bn.			2		3	3	
Sig Spt Co.....	11-117	1,768	1	236	0	120	
			2		71	7	
Rep Co.....	11-127A	775	1	60	12	5	
			2		31		
Dep Co.....	11-128	420	1	34	6	2	
			2		17	5	
Transportation Corps:							
Hq & Hq Co, Trans							
Hwy Trans Gp.....	55-12	45	1	6		3	
			2		2	5	
Hq & Hq Co, Trans							
Trk Bn.....	55-16A	66	1	6	1	7	
			2		3	9	
Trans Trk Co.....	55-17	366	1	50	1	59	
			2		16	34	
Trans Car Co.....	55-19	235	1	38		69	
			2		10	15	
Trans Tfc Reg Co....	55-500	60	1	8		4	
			2		3	15	

(c) Miscellaneous.

1	2	3	4	5	6	7	8
Unit	T/O & E	Total weight unit in short tons	Lead method	Aircraft requirements		Unused allowable cargo load in short tons	Remarks
				C-123, C-119	C-124		
Miscellaneous:							
Hq & Hq Det, Repl Gp.....	20-52	46	1	6		2	
			2		2	4	
Hq & Hq Det, Repl Bn.....	20-56	36	1	5		4	
			2		2	14	
Repl Co.....	20-57	12	1	2		4	
			2		1	13	
Army Postal Unit, Type G.....	12-605	5	1	2		11	
			2		1	20	
Army Postal Unit, Type H.....	12-605	5	1	2		11	
			2		1	20	
Army Postal Unit, Type K.....	12-605	8	1	2		8	
			2		1	17	
Sec Disbursing, Fin (AB, BM, CD, DE).....	14-500	10	1	2		6	
			2		1	15	
Sec Disbursing, Fin (AC, BM, CB, DE).....	14-500	10	1	2		6	
			2		1	15	
Spl Svc Co.....	28-17	125	1	10		5	
			2		5		
Det, CIC (AA, FA)	30-500	8	1	1			
			2		1	17	
Det, CIC (AB, FB)...	30-500	22	1	3		2	
			2		1	3	
Photo Intrpr Tm.....	30-600	8	1	1		0	
			2		1	17	
Mil Intel Svc Orgn....	30-600	213	1	27		3	
			2		9	12	
Mil Govt Gp.....	41-500	82	1	11		6	
			2		4	18	
Mil Govt Co (AB)...	41-500	51	1	7		5	
			2		3	24	
Mil Govt Plat (AA)...	41-500	12	1	2		4	
			2		1	13	
Loudspeaker & Leaflet Co	20-77A	108	1	11	2	30	
			2		5	17	

Plat Hq only—
Does not include
all operational
personnel.

57. Movement by Water

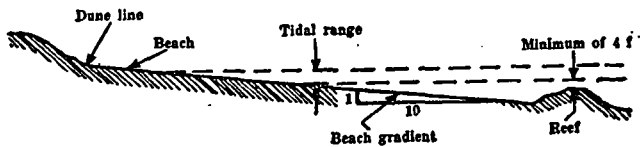
a. Capacities of ships and craft, sea distances, steaming rates, turnaround times, and factors for cargo shipping are contained in chapter 7.

b. Amphibious Assault.

(1) *Beach analysis and selection.* Strategic considerations aside, the selection of a beach for an assault landing is based upon the potential of the beach and hinterland to permit the initial landing and the follow-up logistical support of the forces required for the operation until such time as port facilities can be established. From a logistical standpoint, the most important considerations are the characteristics of the beach, beach exits, and hinterland, and the forecast weather conditions as they influence the ability of the service forces to support and maintain the forces ashore.

(2) *Considerations in selecting.* The factors of primary importance when investigating beaches for amphibious landings are as follows:

(a) *Hydrographic.* Hydrographic factors to be considered are tides, surfs, beach gradients, reefs, and characteristics of bottom and beach surfaces. (The diagram below depicts certain of the features discussed.)



(b) *Tides.* The stage of the tide and the tidal range are considered as they affect the passage of underwater obstacles, offshore bars, reefs or shoals, the beaching or stranding of landing craft, and the width of the beach available for operations.

(c) *Surf.* Waves breaking onto a beach may cause landing craft to broach to. This necessitates a study of surf in connection with landing operations. Surf action is dependent on wind, tide and the depth of water. On flat beaches, waves break and are spent before reaching the shore line. Over steep slopes the surf breaks near the shore and consequently will have more effect on the beaching of craft. Waves usually break over reefs where they exist, and thus leave the inner area relatively unaffected. LCVP's can operate satisfactorily in a surf of

3 or 4 feet, DUKW's in a surf of 3 to 5 feet; in greater surfs, operations should be undertaken only in an emergency.

- (d) *Beach gradient.* Gently shelving beaches cause landing craft to ground at a considerable distance from the shore line, which increases the hazard and time of unloading. A beach gradient of 1 on 10 is nearly ideal. Steep gradients are difficult in bad weather because of surf conditions and the difficulty of getting cargo away from landing craft.
- (e) *Reefs.* In many places, reefs or shoals fringe the shore lines and must be studied prior to beaching operations. A minimum depth of water of 4 feet should be available over reefs or shoals at low tide. This is not the normal situation since most reefs are either very close to the surface or entirely exposed at low tide, in which case certain craft must operate at high tide only. Reefs or shoals which limit operations should be avoided in the selection of beach sites.
- (f) *Weather.* Predicted weather conditions must be considered in relation to the projected operation. Adverse weather conditions and their effects upon tide and surf may make the operations too hazardous, or impossible. Haze or fog conditions may be advantageous or disadvantageous, depending upon over-all considerations of the operation in question. The weather considerations should cover the entire operation and insure favorable conditions for not only the assault landings, but also the follow-up and build-up phases.
- (g) *Topographic.* Having effected a lodgment ashore the landing forces will be confronted with expanding the beachhead and general movement inland. Here topographic features are of immediate importance. Consideration should be given to over-all length of beach, degree of access to the beach (number of corridors and utility of each, the existing road net to and from the beach), areas suitable for supply dumps (both in the beach area and inland), and cover and concealment. It is important that each of these factors be analyzed with respect to the advantages or disadvantages that a particular site may offer.
- (h) *Equipment.* Requirements for equipment to approach and unload supplies over the beach must be determined by beach characteristics. If available equipment will not be adequate, early effort must be directed toward the procurement of sufficient amounts of the proper types.

- (i) *Enemy action.* This may take either an active or a passive form. Active enemy action includes the use of existing defense installations, established fields of fire, and employment of the defending forces. Enemy air and naval capabilities also must be considered. Passive enemy action includes obstacles, demolitions, and mines in water adjacent to the beach, on the beach, and immediately inland. All of these will affect the ability of the service troops to furnish the necessary logistic support.
 - (j) *Troop availability.* An analysis must be made of troops available for the operation which will include the degree of training, experience, and general suitability of both combat and service elements for the operation under consideration.
 - (k) *Time.* The time and place for launching an operation are decided after an analysis of the factors discussed in (a) through (j) above. In addition, the exact time (week, day, and hour) for the assault will be influenced by visibility (as it affects surprise and operations) in the relative number of hours of darkness, moonlight, and daylight. Whether the landing is made in darkness or daylight is determined largely by the relative effectiveness of the fire and support of the assaulting and defending forces.
- (3) *Beach capacity for assault landing.*
- (a) *Size of beaches.* The number of troops which can be landed simultaneously in assault over a given beach is the result of a combination of factors. The tactical formation employed by the assault troops should be the dominant factor, provided safety precautions and good judgment are not sacrificed. In general, the width of beach employed for landing an infantry battalion or other organization in assault should conform to the normal frontage assigned for land combat. For the infantry battalion this normally will be not less than 500 yards nor more than 1,000 yards, an average of 750 yards.
 - (b) *Time and space factors for landing craft and amphibian tractors.* The interval between landing craft or amphibian tractors landed simultaneously on a beach will vary from 50 yards to 100 yards, an average of 75 yards. The time interval between waves will vary from 1 minute to 15 minutes.

- (c) *Average landing times.* The battalion landing team of approximately 1,300 men requires an average of 55 amphibian tractors or 40 landing craft (LCVP). These are divided into waves, with each successive wave organized to ensure a logical tactical build-up on shore. The number of waves varies from three to seven depending upon beach frontage, restricted offshore passages caused by natural and artificial obstacles, the tactical plan ashore, and contemplated enemy resistance. As a rule of thumb, a battalion landing team in assault should be landing on the beach in 30 minutes. A shorter time lapse is desirable when practicable.
- (d) *Follow-up waves.* Experience indicates that waves of boats landed subsequently to the assault battalions normally will take longer to unload because they carry more vehicles and supplies. At least 15 minutes' time interval should be allowed between these waves. However, the increased time interval between waves is offset by the ability to land boats closer together.
- (e) Assault shipping required for a reinforced infantry division varies according to the tactical mission and the length of the voyage.
1. For long voyages (10 days, for example) primary consideration must be given to provision of the type of shipping that will negotiate the distance at a suitable speed and that will best accommodate the embarked troops. APA's and AKA's meet these requirements better than landing ships. Assault shipping for a reinforced infantry division for an extended voyage, therefore, conforms to the following average pattern:

Type ship	Personnel	Vehicles	Number of ships	Total personnel	Total vehicles
APA.....	1,300	50	15	19,500	750
AKA.....	250	120	6	1,500	720
LST*.....	300	60	12	3,600	720
LSM*.....	50	10	12	600	120
LSD*.....	240	50	3	720	150
Total.....				25,920	2,460

*Number of landing ships varies in proportion to number of amphibian tractors, DUKW's, ground combat vehicles, and LCT's and LCM's to be carried.

2. For short voyages (48-72 hours, for example) accommodation of embarked troops can be subordinated to

RESTRICTED—Security Information

provision of the most suitable shipping for ease and efficiency in loading and unloading. Landing ships meet these requirements better than APA's and AKA's, especially when ground combat vehicles and amphibian tractors are considered. Assault shipping for a reinforced infantry division for a short voyage, therefore, conforms to the following pattern:

Type ship	Personnel	Vehicles	Number of ships	Total personnel	Total vehicles
APA.....	1,300	50	9	11,700	450
AKA.....	250	120	6	1,500	720
LST*	300	60	36	10,800	2,160
LSM*	50	10	12	600	120
LSD*	240	50	3	720	150
Total.....				2,320	3,600

*Number of landing ships varies in proportion to number of amphibian tractors, DUKW's, ground combat vehicles, and LCT's and LCM's to be carried.

3. It will be noted, in comparing the patterns of assault shipping for extended and short voyages, that although the personnel lift remains approximately equal, the number of vehicles lifted in the assault shipping for a short voyage greatly exceeds the number lifted in the assault shipping for a long voyage. This is due to the fact that the landing ships carry a balanced personnel and vehicle load as compared with APA's which carry large numbers of personnel but few vehicles.
 4. Available shipping will always affect the composition of assault shipping. Efficient loading and allowable overloads likewise affect the number of personnel and vehicles that can be loaded. For example, it was common in both Europe and the Pacific to load 500 troops on LST's.
- (f) *Vehicles and supply.* Vehicles and supply carried by the assault and early follow-up waves may be substituted for men as given in the above tables on the basis of space or weight, whichever is the determining factor in each case. The boat space occupied by one man and his individual equipment normally is considered to be 224 pounds, 13.5 cubic feet or 3 square feet.

c. River Crossing.

- (1) *Bridges.* In an assault on a river line, the number of bridges provided for each tactical unit will vary widely depending upon many factors. Some of these are width of river, stream velocity, the available road net, trafficability of the soil, the types and amounts of equipment available, and the number of available engineer troops. As a rule, at least one floating bridge to take division loads will be necessary within the zone of each assault division. These bridges normally will be supplemented by one additional bridge per corps zone and at least one in the army zone. Communications zone troops ordinarily will provide a railroad bridge in the zone of each army.
- (2) *Ferries.* In addition to the factors discussed above, the numbers and types of ferries used will be affected by the number of bridges planned and by the extent to which landing craft and amphibious vehicles are employed. For narrow streams, it frequently will be more economical to construct a bridge at each available site than to use ferries. On the other hand, in crossing a wide river when the construction of bridges will be delayed, ferries of all types will be used to the greatest degree possible.
- (3) Detailed characteristics of bridging and ferrying equipment are shown in paragraphs 73 and 74.

Section III. TRAINING**58. Maneuver Area**

a. Divisional weapons, particularly the 90mm and 120mm tank guns, have outmoded the criteria applicable for World War II training ranges. The 90mm tank gun should be allowed a minimum of 24,400 yards (13.9 miles) to permit fully realistic training in combat fire. The 120mm gun requires a firing range of 35,000 yards (19.9 miles). Consequently, installations which have previously been utilized for training of divisions are no longer capable of meeting fully the present day requirements.

RESTRICTED—Security Information

b. Data on installation areas in approximate acreages are as follows:

Type units	Approximate number troops	Cantonment area	Miscellaneous activities area	Field exercise area	Firing and impact area	Total
Inf Div.....	* 30,000	2,200	1,000	50,000	90,000	143,200
Arm'd Div.....	* 30,000	2,200	1,000	70,000	140,000	213,200
Abn Div.....	* 30,000	2,200	1,000	50,000	b 90,000	143,200
Corps Troops.....	* 30,000	2,400	1,000	10,000	40,000	53,400
AAA Firing Center.....	d 2,500	d 250	d 150	e 6,000	e 70,000	76,400
Tank Firing Center.....	f 2,500	f 250	f 150	Not required	140,000	140,400

* Includes divisional, nondivisional and supporting troops (aggregate strength).

b Consideration must be given to cleared areas for drop zone and assault transport landing areas. An airfield capable of taking large transports should be nearby. An airborne division maneuver area should contain an airfield, capable of handling large airplanes, immediately adjacent to the cantonment area. One or more large drop and assault transport landing zones should be located near the cantonment area, and the others scattered throughout the maneuver area. At least one such zone should be located adjacent to the firing and impact area to permit conduct of small unit problems using live ammunition.

c Normal assignment of corps troops plus $\frac{1}{2}$ of normal army engineer and army AAA units.

d Per group of two AW battalions and one gun battalion.

e Provides position areas and danger areas for simultaneous firing of three gun battalion through 45° safety angle. Danger area may be sited over water.

f Per 3 tank battalions and proportionate station overhead.

59. Training Facilities for Infantry, Airborne and Armored Divisions

a. The cantonment area should be located near the perimeter of the land available, accessible to highways and railroad facilities. The area should provide all housing, storage, railroad yards, administration, shops, close-in training areas, miscellaneous training courses and recreational facilities. For a functional layout of division type camps see OCE drawing number E-16-06-21 and E-16-06-22 obtainable from Office, Chief of Engineers.

b. The miscellaneous activities area includes the station hospital, airfields, divisional review field, and other administrative activities not included in the cantonment area.

c. The field exercise area includes all available land except that used for cantonment, miscellaneous activities, and firing and impact area. Portions of the firing and impact area not in use when the exercises are conducted may be utilized as field exercise area. It is desirable that this area contain streams or lakes for training in construction of fixed and floating bridges.

d. Firing and impact area permits the firing of all ranges simultaneously, except, in some cases, those whose impact areas are superimposed. For suggested layout see SR 210-20-20. This area should be of size shown therein and of varied terrain with suitable locations for ground observation points. The impact area may be submarginal or swamp land.

- e.* The division review field should be an area at least 3,000 by 1,000 yards, adjacent to or near the cantonment area.
- f.* Drill fields should be located in close proximity to each regimental area.
- g.* The landing field requires suitable terrain, and should be available in the vicinity of the cantonment area for use by organic aircraft.
- h.* An airfield suitable for use by large numbers of transport aircraft should be on or near the installation.
- i.* The close-in training area, in order to permit the maximum use, should be located in close proximity to the housing area.
- j.* Ranges for the infantry, airborne, and Armored Division posts may be found listed in SR 210-20-20 together with the number of ranges, positions, lanes, bays or firing points required for each type of unit, also the drawing number from which they may be constructed and the appropriate training manual reference.

[illegible]

For umpire requirements, see FM 105-5.

Section IV. TACTICAL OPERATIONS**62. Characteristics of Weapons**

a. *Vehicular Weapons, Combat Vehicles.* (See par. 107)

b. *Infantry Weapons.*

	1	2	3	4	5	6
1	Weapon	Maximum rate of fire rds/m	Sustained rate of fire rds/m	Maximum range (yards)	Maximum effective range (yards)	Effective radius of burst (yards)
2	Carbine, cal .30, M2.....	750-775	40-60	2,200	300	-----
3	Grenade, hand fragmentation, Mk IIA1.....	-----	-----	35-40	35-40	30
4	Grenade, hand, offensive, Mk IIIA1.....	-----	-----	35-40	35-40	-----
5	Grenade, rifle, fragmentation, M17.....	-----	-----	290	290	3-5
6	Grenade, AT, M9A1.....	4	4	365	75 pt tgt 330 area tgt	10
7	Flame thrower, portable, M2A1.....	-----	8-9 seconds	-----	-----	-----
	Unthickened fuel.....	-----	-----	-----	20	-----
	Thickened fuel.....	-----	-----	55-65	45	-----
8	Machine gun, heavy, cal .30, M1917A1.....	450-600	125	3,500	-----	-----
	Antiaircraft.....	-----	-----	-----	700	-----
	Ground.....	-----	-----	-----	2,000	-----
9	Machine gun, light cal .30, M1919A6.....	400-550	60	3,500	-----	-----
	Antiaircraft.....	-----	-----	-----	700	-----
	Ground.....	-----	-----	-----	2,000	-----
10	Machine gun, light, cal .30, M1919A4.....	400-550	60	3,500	-----	-----
	Antiaircraft.....	-----	-----	-----	700	-----
	Ground.....	-----	-----	-----	2,000	-----
11	Machine gun, heavy, cal .50, HB M2, on grd mount, M3.....	400-600	40	7,400	-----	-----
	Antiaircraft.....	-----	-----	-----	1,000	-----
	Ground.....	-----	-----	-----	2,000	-----
12	Mortar, 60-mm, M19 with mount, M5.....	30-35	18	-----	-----	-----
	Shell, HE M49.....	-----	-----	1,985	1,985	11
	Shell, WP M302.....	-----	-----	1,610	1,610	11
13	Mortar, 60-mm, M19 with baseplate, M1.....	10-15	10	816	500	11
14	Mortar, 81-mm, M1 with mount, M4.....	30-35	18	-----	-----	-----
	Shell, HE L, M43.....	-----	-----	3,290	3,290	17
	Shell, HE H, M56.....	-----	-----	2,596	2,596	20
	Shell, WP, M57.....	-----	-----	2,465	2,465	17
	Shell, I11, M301.....	-----	-----	2,450	2,450	0
15	Mortar, 4.2-in., M2.....	20	5	-----	-----	-----
	Shell, HE, M3.....	-----	-----	4,400	4,400	20
	Shell, WP, M2.....	-----	-----	4,260	4,260	20

b. Infantry Weapons—Continued

	1	2	3	4	5	6
1	Weapon	Maximum rate of fire rds/m	Sustained rate of fire rds/m	Maximum range (yards)	Maximum effective range (yards)	Effective radius of burst (yards)
16	Mortar, 4.2-in., M30..... Shell, HE, M329..... Shell, smoke, WP, E84.....			6,000		
17	Pistol, automatic, cal .45, M1911A1.....	21-28	10	1,640	50	
18	Rifle, automatic, Browning, cal .30, M1918A2.....	350-550	40-60	3,500	500	
19	Rifle, cal .30, M1.....	16-32	16	3,500	500	
20	Rifle, cal .30, M1C and M1D.....	10-15	10	3,500	800-1,000	
21	Rifle, 57-mm, M18..... Cartridge, HE, M306..... Cartridge, HEAT, M307..... Cartridge, smoke, WP, M306.....	8	2	4,340 4,340 4,340	1,900 1,200 1,900	34 × 10 0 11
22	Rifle, 75-mm, M20..... Cartridge, HE, M309..... Direct fire..... Indirect fire..... Cartridge, HEAT, M310..... Cartridge, smoke, WP, M311..... Direct fire..... Indirect fire.....	8	2	6,955 2,100 6,955 7,200 7,020 2,100 7,020		45 × 15 0 15
23	Rifle, 105-mm, M27..... Cartridge, HE..... Cartridge, AT..... Cartridge, smoke..... Direct fire..... Indirect fire.....	9	2	8,300 8,300 8,300 2,000 8,300		50 × 15
24	Rocket launcher, 2.36-in., M9A1 and M18..... Area targets..... Point targets.....	8	4	700 700 300		20
25	Rocket launcher, 3.5-in., M20..... Area targets..... Point targets.....	8	4	900 900 400		20
26	Submachine gun, cal. 45, M3A1.....	450	40-60	1,760	100	

c. Artillery Weapons.

(1) Ground artillery.

	1	2	3	4	5	6	7	8
1	Type, caliber, and carriage model	Time to emplace (min-utes)	Maxi-mum rate of fire (rounds per miunte) ¹	Projectiles				
				Effective area of burst (yards)		Weight (pounds)	Maximum range (yards)	
							100 percent	85 percent
2	75-mm pack howitzer, M1A2 (carriage, M8).	3	6	30	10	15	9,610	8,168
3	76-mm gun, M1A2 (motor carriage, M1A2).	-----	20	30	10	22.5	14,000	11,900
4	90-mm gun, M3 and M3A1 (motor carriage, M36).	-----	8	40	15	² 24.4 23.4	³ 4,000 13,000	11,050
5	105-mm howitzer, M2A1 and M2A2 (carriage, M2A2).	3	4	50	15	² 23.7 33	³ 5,000 12,205	-----
6	105-mm howitzer, M4 and M4A1 (motor carriage, M37).	-----	4	50	15	33	11,400	9,690
7	4.5-inch multiple rocket launcher, M21.	3 min	24	50	15	42.5	6,300	4,225
8	155-mm howitzer, M1 and M1A1 (carriage M1A2).	5	1	60	18	95	16,355	13,902
9	155-mm howitzer, M1 and M1A1 (motor carriage M41).	1	2	60	18	95	16,355	13,902
10	155-mm gun, M2 and M2A1 (carriage, M1).	½ to 2 hr	½	60	18	95	25,715	21,857
11	155-mm gun, M2 and M2A1 (motor carriage M40).	1	½	60	18	95	25,715	21,857
12	8-in howitzer, M2 (carriage, M1)	½ to 2 hr	½	80	20	200	18,510	15,733
13	8-in howitzer, M2 (motor carriage M43).	1	½	80	20	200	18,510	15,733
14	8-in gun, M1 (carriage, M2)	4 to 8 hr	½	80	20	286	35,490	30,166
15	240-mm howitzer, M1 (carriage, M1).	4 to 8 hr	½	100	25	360	25,225	21,467
16	280-mm gun T131.	15	¼	200	60	600	⁴ 15,179 31,200	12,902 26,500
	(Carriage TT2)	-----	-----	-----	-----	-----	⁴ 13,900	⁴ 11,615

¹ Maximum prescribed rate of fire.² Armor-piercing projectile.³ Armor-piercing projectile against armored targets.⁴ Using minimum powder charge.

(2) *Antiaircraft artillery* (including automatic weapons.)

(a) *General.*

	1	2	3	4	5	6	7
	Type, model and carriage model	Time to emplace (minutes)	Maximum rate of fire (rounds per minute)	Range (yards)			
				Horizontal		Vertical	
				Maximum	Fuse limit	Maximum	Fuse limit
2	Motor carriage, M16, with multiple (4) cal .50 machine gun mount, M45.	-----	1,800	7,125	-----	1 7,000	-----
3	Trailer, multiple (4) cal .50 machine gun mount, M55.	* 3	1,800	7,125	-----	1 7,000	-----
4	Motor carriage, M15A1, with combination mount, M54 (1—37-mm automatic gun, M1A2, and 2 cal .50 machine guns).	-----	Cal.501,800 37-mm 120	7,125	-----	7,000	-----
5	40-mm automatic gun, M1, on carriage, M2A1, AA.	* 3-5	* 120	* 5,500	* 5,500	5,500	* 5,500
5	Motor carriage, 40-mm, M19, with twin mount, M4.	-----	* 240	* 5,500	* 5,500	5,500	* 5,500
7	75-mm AA gun mount, T59.	30	50	15,000	* 7,200	7,000	* 6,200
8	90-mm gun, M2, AA, on mount, M2, AA.	20	25	19,980	7 12,425	13,170	7 11,625
9	120-mm gun, M1, AA, on mount, M1A1, AA.	60	10	28,250	16,400	20,600	7 16,500

¹ Maximum practical vertical range, limited by length of burning of tracer (1,800 yd).

² May be fired from traveling position.

³ To emplace with director—15 to 30 minutes.

⁴ Manual (single shot)—60 rounds per gun per minute.

⁵ For tactical planning—2,000 yd.

⁶ 12 second fuse limit.

⁷ 30 second fuse limit.

⁸ 15 second fuse limit.

(b) *Ranges of automatic weapons.*

1	2	3	4	5	6	7	8	9
Maximum deterrent slant range (yards) ¹			Maximum killing slant range (yards) ¹			Effective killing slant range (yards) ¹		
40-mm director control	40-mm M7 sight control	.50 cal MG ²	40-mm director control	40-mm M7 sight control	.50 cal MG	40-mm director control ³	40-mm M7 sight control	.50 cal MG
3,500	3,500	1,800	2,500	1,500	900	* 1,500-400	* 1,000-400	500-0

¹ Slant range is distance from weapon to target.

² Tracer burn out range. The extent of deterrent effect of .60 caliber tracer is questionable.

³ Average hit expectancy, or number of hits expected, per 100 rounds fired is 4 percent.

⁴ Minimum range limited by maximum tracking rate. For targets diving directly at the gun, minimum range would be unlimited.

(3) *Field artillery barrages and concentrations.*

(a) *Barrages.* A barrage is a special type of prearranged fire placed on a line.

	1	2	3	4		5			
1	Caliber and type	Area effectively covered by one projectile ¹ (width×depth) (yards)	Radius of large fragments (yards)	Width of battery barrages (yards)		Permissible rates of fire rounds per piece			
				Size of battery		1st ½ Min	1st ¼ Min	1st 10 Min	Pro- longed fire (rds per hour)
				4-piece	6-piece				
2	75-mm howitzer.....	30×10	150	100	100	8	24	48	150
3	105-mm howitzer.....	50×15	300	100	150	4	16	30	100
4	155-mm howitzer.....	60×18	550	200	250	2	8	16	40
5	155-mm gun.....	60×18	550	(*)	-----	2	8	14	40
6	8 in howitzer or gun..	80×20	-----	(*)	-----	How Gun	6	10	30
7	240-mm howitzer.....	100×25 ³	-----	(*)	-----	-----	3	6	20
8	280-mm gun T131....	200×60 ³	-----	(*)	(*)	-----	1	-----	-----

¹ The area covered effectively is considered to be that area in which there is at least 50 percent chance that a man standing will become a casualty. The area is roughly elliptical.

² Not suitable for firing close to friendly troops. May be used to add depth to barrage.

³ Estimated.

⁴ Two guns per battery.

(b) *Concentrations.* A concentration is a volume of fire placed on an area within a limited time.

	1	2	3	4	5	6	7	8	9
1	Area and ammunition	Unit							Remarks
		75-mm How Bn		105-mm How Bn		155-mm How Bn		8-in. How Bn	
		4-piece btry	6-piece btry	4-piece btry	6-piece btry	4-piece btry	6-piece btry	4-piece btry	
2	Approximate size of area covered. ¹	100×200	150×200	200×200	250×200	300×200	350×200	400×200	Firing with open sheaf.
3	Amount of ammunition to cover (rounds).	96	108	60	72	60	72	60	

¹ The area covered effectively is considered to be that in which there is at least 50 percent chance that a man standing will become a casualty. The area is roughly elliptical.

63. Characteristics of Chemical Weapons, Agents, and Munitions

a. Characteristics of Chemical Weapons.

1	Weapon	2		3	5	5	6	7	
		Weight		Transportation	Fuel tank capacity (gal)	Fuel consumption rate	Duration of continuous fire (sec)	Maximum effective range	
		Empty (lb)	Filled (lb)					Liquid fuel (yd)	Thickened fuel (yd)
2	Flame thrower, portable, M2A1.....	43	72	Man carried.....	5	1/4 to 3/4 gal/sec.....	6 to 9.....	20.....	45
3	Flame thrower, mechanized, M3-4-3.....	677	977	Medium tank.....	50	1 gal/sec.....	50.....	25 to 30.....	50 to 70.
4	Flame thrower, mechanized, M6.....	693	1,013	Medium tank.....	50	3/10 gal/sec.....	35.....	20 to 30.....	40 to 60.
	3/16-in nozzle.....					1 gal/sec.....	25.....		
	3/16-in nozzle.....					1 1/4 gal/sec.....	20.....		
5	Flame thrower, combat vehicle, main armament, M5-4.....			Medium tank.....	315				
	1/2-in nozzle.....					2.2 gal/sec.....	130.....		105.
	3/4-in nozzle.....					4.4 gal/sec.....	65.....		140.
6	Generator, smoke, mechanical, M2A1.....	180	266	3/4-ton truck and trailer.....			Continuous.....	Not applicable.....	Not applicable.....
	Fog oil.....				No tank	50/gal/hr.....			
	Water.....				6	5/gal/hr.....			
	Gasoline.....				6	5/gal/hr.....			
7	Generator, smoke, mechanical, M3.....	137	158	3/4-ton truck and trailer.....			Continuous.....	Not applicable.....	Not applicable.....
	Fog oil.....					50 gal/hr.....			
	Gasoline.....					3 gal/hr.....			

RESTRICTED—Security Information

RESTRICTED

b. Characteristics of Chemical Agents.

(1) Nerve gases.

	1	2	3	4	5	6	7	8	9	10	11
1	Name	Symbol	Marking	Odor (commonly accepted)	Persistency			Classification		Effect on body	Possible methods of dispersion
					Summer	Winter	Status ¹	Tactical	Physiological		
2	G-series.....	GB	1 green band GB GAS.	Hardly detect- able, none when pure.	10 min. to 12 hr.	10 min. to 12 hr.	S	Casualty gas.	Nerve poisons.	Causes blurred vision with pin- point pupils, skin and eye spasms, difficult breath- ing, tight chest, salivation, mental confusion, convul- sions.	Artillery, bomb, mortar, rocket.
3	G-series.....	GA	1 green band GA GAS.	Fruity, sweetish.	10 min. to 12 hr.	10 min. to 12 hr.	LS	Casualty gas.			

¹ S—Standard; SS—Substitute Standard; LS—Limited Standard.

(2) Blood poisons.

2	Cyanogen chloride.	CK	1 green band CK GAS	Biting.....	1-10 min ...	1-10 min ...	SS	Casualty gas.	Systemic poisons.	Injures lungs; causes paralysis.	Bomb, mortar, rocket grenade.
3	Hydrocyanic acid.	AC	1 green band AC GAS.	Bitter almonds..	1-10 min...	Several hours.	SS	Casualty gas.	Systemic poisons.	Injures lungs; causes paralysis.	Bomb, mortar, rocket grenade.

(3) *Blister gases.*

2	Mustard, distilled.	HD	2 green bands HD GAS.	Garlic or horse- radish.	3-4 days, ¹ 1 week. ²	Several weeks.	S	Casualty gas.	Blister gas.	Injures eyes and lungs; blisters skin.	Bomb, artillery, mortar, rocket, landmine, spray.
3	Mustard.....	H	2 green bands H GAS.	Garlic or horse- radish.	3-4 days, ¹ 1 week. ²	Several weeks.	SS	Casualty gas.	Blister gas.	Injures eyes and lungs; blisters skin.	Bomb, artillery, mortar, rocket, landmine, spray.
4	Nitrogen must- ard.	HN1	2 green bands HN GAS.	Odorless to faint fishy or soft soap odor.	3-4 days, ¹ 1 week. ²	Several weeks.	SS	Casualty gas.	Blister gas.	Injures eyes and lungs; blisters skin.	Bomb, artillery, mortar, rocket, landmine, spray.
5	Mustard-T mixture.	HT	2 green bands HT GAS.	Garlic or horse- radish.	More per- sistent than HD.	More per- sistent than HD.	SS	Casualty gas.	Blister gas.	Injures eyes and lungs; blisters skin.	Bomb, artillery, mortar, rocket, landmine, spray.
6	Lewisite.....	L	2 green bands L GAS.	Irritating, sometimes like geraniums.	1 day, ¹ 2-3 days. ²	1 week or more.	SS	Casualty gas.	Blister gas.	Injures eyes and lungs; blisters skin.	Bomb, artillery, mortar, rocket, landmine, spray.

¹ In open.

² In woods.

(4) *Choking gases.*

2	Phosgeno.....	CG	1 green band CG GAS.	Fresh cut hay; ensilage.	5 min, ¹ 10 min. ²	10 min, ¹ 20 min. ²	S	Casualty gas.	Choking gas.	Injures lungs, caus- ing accumulation of fluid.	Bomb, mortar, rocket.
---	---------------	----	-------------------------	-----------------------------	---	--	---	------------------	-----------------	---	--------------------------

¹ In open.

² In woods.

RESTRICTED

(5) Vomiting gases.

	1	2	3	4	5	6	7	8	9	10	11
1	Name	Symbol	Marking	Odor (commonly accepted)	Persistence		Status ¹	Classification		Effect on body	Possible methods of dispersion
					Summer	Winter		Tactical	Physiological		
2	Adamsite.....	DM	1 red band DM GAS.	Odorless or slightly like coal smoke.	1-10 min...	1-10 min...	S	Harassing gas.	Vomiting gas.	Headache, nausea, violent sneezing, coughing, temporary mental depression.	Candle, grenade.
3	Diphenyl-chloroarsine.	DA	1 red band DA GAS.	Odorless or slightly like coal smoke.	1-10 min...	1-10 min...	SS	Harassing gas.	Vomiting gas.	Headache, nausea, vomiting, sneezing.	Candle, grenade.

(6) Tear gases.

2	Chloroaceto-phenone.	CN	1 red band CN GAS.	Apple blossoms..	1-10 min...	1-10 min...	S	Harassing gas.	Tear gas....	Causes crying, irritates skin.	Grenade, pot.
3	CN solutions...	CNC	1 red band CNC GAS.	Chloroform.....	1-10 min...	1-10 min...	S	Harassing gas.	Tear gas....	Causes crying, irritates skin.	Bomb, artillery, mortar, spray.
		CNS	1 red hand CNS GAS.	Sweetish.....	1 min. to 1 hr.	1 min. to 1 hr.	LS	Harassing gas.	Tear gas....	Causes crying, irritates skin.	Bomb, artillery, mortar, spray.
		CNB	1 red hand CNB GAS.	Benzene.....	1 min. to 1 hr.	1 min. to 1 hr.	LS	Harassing gas.	Tear gas....	Causes crying, irritates skin.	Bomb, artillery, mortar, spray.

(7) Screening smokes.

2	White phosphorus.	WP	1 yellow band WP SMOKE.	Burning matohes.	(1)	(1)	S	Screening smoke.	None.....	Solid particles burn skin.	Bomb, artillery, mortar, grenade, rocket.
---	-------------------	----	-------------------------	------------------	-----	-----	---	------------------	-----------	----------------------------	---

3	Plasticized white phosphorus.	PWP	1 yellow band PWP SMOKE.	Burning matches	(1)	(1)	S	Screening smoke.	None	Solid particles burn skin.	Bomb, artillery, mortar, grenade, rocket.
4	Sulfur trioxide solution.	FS	1 yellow band FS SMOKE.	Acrid.....	(1)	(1)	SS	Screening smoke.	None.....	Irritates skin.....	Artillery, mortar, rocket spray.
5	Titanium tetrachloride.	FM	1 yellow band FM SMOKE.	Acrid.....	(1)	(1)	SS	Screening smoke.	None.....	None.....	Artillery, mortar, rocket, spray.
6	Hexachloroethane mixture.	HC	1 yellow band HC SMOKE.	Acrid.....	(1)	(1)	S	Screening smoke.	None.....	None.....	Bomb, artillery, mortar, grenade, pot.
7	Fog oil ¹	SGF1 SGF2	SGF OIL.....	Like petroleum oil.	(1)	(1)	S	Screening smoke.	None.....	None.....	Mechanical smoke, generator.

¹ Persistency of smoke agents is subject to atmospheric conditions.

² SGF1 and SGF2 are summer and winter grade fog oils, respectively.

³ Procured by Cml C; issued by QMC.

(8) *Signaling smokes.*

2	Green smoke....	GS	1 yellow band, color indicated.	Acrid.....	(1)	(1)	S	Signaling....	None.....	None.....	Artillery, bombs, grenades.
3	Red smoke.....	RS	1 yellow band, color indicated.	Acrid.....	(1)	(1)	S	Signaling....	None.....	None.....	Artillery, bombs, grenades.
4	Violet smoke....	VS	1 yellow band, color indicated.	Acrid.....	(1)	(1)	S	Signaling....	None.....	None.....	Artillery, bombs, grenades.
5	Yellow smoke....	YS	1 yellow band, color indicated.	Acrid.....	(1)	(1)	S	Signaling....	None.....	None.....	Artillery, bombs, grenades.

¹ Persistency of signaling smokes is subject to atmospheric conditions.

RESTRICTED

(9) *Incendiary agents.*

	1	2	3	4	5	6	7	8	9	10	11
1	Name	Symbol	Marking	Odor (commonly accepted)	Persistence			Classification		Effect on body	Possible methods of dispersion
					Summer	Winter	Status ¹	Tactical	Physiological		
2	Thermate.....	TH	1 purple band TH INCEND.	None.....	None.....	None.....	S	Incendiary..	None.....	Burns.....	Bomb, grenade, equipment destroying incendiary.
3	Flare Mixture..	F8	1 purple band INCEND.	None.....	None.....	None.....	S	Incendiary..	None.....	Burns.....	Bombs.
4	Incendiary mixture.	PTI	1 purple band INCEND.	None.....	None.....	None.....	S	Incendiary..	None.....	Burns.....	Bombs.
		IM	1 purple band IM INCEND.	None.....	None.....	None.....	S	Incendiary..	None.....	Burns.....	Bombs.
5	Incendiary oil...	NP	1 purple band NP INCEND.	None.....	None.....	None.....	S	Incendiary..	None.....	Burns.....	Bomb, flame thrower, fire starter.
		NP2	1 purple band INCEND.	None.....	None.....	None.....	SS	Incendiary..	None.....	Burns.....	Bombs.
		OT	1 purple band INCEND.	None.....	None.....	None.....	S	Incendiary..	None.....	Burns.....	Bombs.
6	Thickener, M1, M2, M3.	None	None.....	None.....	None.....	None.....	S, LS, ¹ SS	None.....	None.....	Burns.....	¹ .

¹ Thickener M1 and M3 are standard; M2 is limited standard.² Thickener, M1 (napalm), thickener, M2 (antiagglomerated napalm), and thickener, M3 (octal) are used to thicken gasoline for use in flamethrowers and bombs.

RESTRICTED

RESTRICTED—Security Information

c. Data on Chemically Filled Munitions.

	1	2	3	4	5	6	7
	Munition	Status ¹	Agent and weight of filling (pounds unless otherwise indicated)	Weight of filled projectile (pounds unless otherwise indicated)	Approximate time for agent to burn or evaporate at point of release ²	Marking and color	Chemical efficiency (percent) ³
	<i>Grenade</i>						
2	Grenado, hand, irritant, ON-DM, M6.....	S	CN-DM.....0.64	1.06	Aprx. 1 mln.....	CN-DM GAS; 1 red band....	61
3	Grenade, hand, tear, CN, M7A1.....	S	CN.....0.79	1.06	Aprx. 1 mln.....	CN GAS; 1 red band.....	75
4	Grenade, hand, tear, CN, M7.....	SS	CN.....0.64	1.06	Aprx. 1 mln.....	CN GAS; 1 red band.....	61
5	Grenade, smoke, white, HC, AN-N8.....	S	HC.....1.2	1.6	2 to 3 mln.....	HC SMOKE; 1 yellow band..	75
6	Grenade, incendiary, AN-M14.....	S	TH.....1.65	2	30 to 45 sec.....	TH INCEND; 1 purple band..	82
7	Grenade, band, smoke, WP, M15.....	S	WP.....0.95	1.93	Approx. 1 mln.....	WP SMOKE; 1 yellow band..	47
8	Grenade, smoke, colored, M18 (4 colors) ⁴	S	Color.....0.72	1.2	Approx. 1 mln.....	1 yellow band; lettering and color of top indicate color of smoke.	60
9	Grenade, band, riot, CN, M25A1.....	S	CN.....0.2	.47	Immediately.....	1 red band on container; none on grenade.	42
10	Grenade, rifle, smoke, WP, M19A1.....	LS	WP.....0.5	1.5	Approx. 1 mln.....	WP SMOKE; 1 yellow band..	33
11	Grenade, rifle, smoke, colored, M22 (4 colors) ⁴	S	Color.....0.4	1.3	Approx. 1 mln.....	1 yellow band (colors indicated).	30
12	Grenade, rifle, smoke, colored streamer, M23 (4 colors) ⁴	S	Color.....0.4	.9	Approx. 12 sec. minimum.	1 yellow band (color indicated).	44
	<i>Incendiaries</i>						
13	Incendiary, equipment destroying, M2A1.....	S	TH.....8.5	11.5	Approx. 1 mln.....	TH; 1 purple band.....	74
14	Incendiary, safe destroying, M1A1.....	S	TH.....28	32	Approx. 1 mln.....	TH; 1 purple band.....	88
	<i>Landmine</i>						
15	Mine, chemical, 1 gallon.....	S	HD.....99.9	12	Approx. 15 sec.....	HD GAS; 2 green bands.....	83

See footnotes at end of table.

RESTRICTED

167

RESTRICTED—Security Information

63

e. Data on Chemically Filled Munitions—Continued

1	2	3	4	5	6	7
Munition	Status ¹	Agent and weight of filling (pounds unless otherwise indicated)	Weight of filled projectile (pounds unless otherwise indicated)	Approximate time for agent to burn or evaporate at point of release ²	Marking and color	Chemical efficiency (percent) ³
<i>Smoke pot</i>						
16 Pot, smoke, HC, M1.....	S	HC.....10.25	12	5 to 8 min.....	HC SMOKE; 1 yellow band..	84
17 Pot, smoke, floating, HC, M4A2.....	S	HC.....27	38	10 to 15 min.....	HC SMOKE; 1 yellow band..	71
18 Pot, smoke, HC, 30-lb, M5.....	S	HC.....27	33	5 to 15 min.....	HC SMOKE; 1 yellow band..	81
19 Pot, smoke, floating, SGF2, MK5 Mod 2.....	S	Fog oil.....12.5	38	8 to 13 min.....	1 yellow band.....	33
<i>2.56-in rocket</i>						
20 Rocket, smoke, WP, M10A4.....	S	WP.....0.89	2.4	Immediately.....	WP SMOKE; 1 yellow band..	26
<i>7.2-in. Rocket</i>						
21 Rocket, gas, CK, M27.....	LS	CK.....18.5	51.8	Immediately.....	CK GAS; 1 green band.....	35
22 Rocket, gas, CG, M25.....	S	CG.....20.6	51.8	Immediately.....	CG GAS; 1 green band.....	39
<i>57-mm rifle</i>						
23 Shell, smoke, WP, M308A1.....	S	WP.....0.37	2.75	Immediately.....	WP SMOKE; 1 yellow band..	13
<i>60-mm mortar</i>						
24 Shell, smoke, WP, M302.....	S	WP.....0.75	4	Approx. 1 min....	WP SMOKE; 1 yellow band..	18
<i>75-mm gun</i>						
25 Shell, smoke, WP, M64.....	S	WP.....1.34	14.7	Immediately.....	WP SMOKE; 1 yellow band..	9

RESTRICTED

<i>75-mm howitzer</i>								
20	Shell, smoke, WP, M64.....	S	WP.....1.34	14.7	Approx. 30 sec....	WP SMOKE; 1 yellow band..	9	
		SS	FS.....1.5	14.7	Approx. 30 sec....	FS SMOKE; 1 yellow band...	10	
<i>75-mm rifle</i>								
27	Shell, smoke, WP, M311A1.....	S	WP.....1.35	15.1	Immediately.....	WP SMOKE; 1 yellow band..	8	
<i>76-mm gun</i>								
28	Shell, fixed, smoke, WP, M312.....	S	WP.....0.73	12.95	Immediately.....	WP SMOKE; 1 yellow band..	5	
<i>81-mm mortar</i>								
29	Shell, smoke, WP, M57A1.....	S	WP.....4.06	12.3	Approx. 1 min....	WP SMOKE; 1 yellow band..	33	
30	Shell, smoke, FS, M57.....	SS	FS.....4.59	12.18	Approx. 1 min....	FS SMOKE; 1 yellow band...	37	
<i>90-mm gun</i>								
31	Shell, smoke, WP, M313.....	S	WP.....1.97	23.64	Immediately.....	WP SMOKE; 1 yellow band..	8	
<i>105-mm howitzer</i>								
32	Shell, smoke, BE, M84.....	S	HO.....4.96	32.86	2-5 min.....	HC SMOKE; 1 yellow band..	15	
			Green.....2.71	30.48	Approx. 1 min....	1 yellow band; color indicated..	Average 9	
			Violet.....2.91	30.48	Approx. 1 min....			
			Red.....2.91	30.68	Approx. 1 min....			
			Yellow.....2.51	30.28	Approx. 1 min....			
33	Shell, smoke, M60.....	S	WP.....4.06	30	Immediately.....	WP SMOKE; 1 yellow band..	13	
		SS	FS.....4.61	30	Immediately.....	FS SMOKE; 1 yellow band...	15	
34	Shell, gas, H, M60.....		H.....3.17	30	3 to 10 days.....	H GAS; 2 green bands.....	10	
<i>105-mm rifle</i>								
35	Shell, chemical, M325.....	SS	WP.....4.06	34.58	Immediately.....	WP SMOKE; 1 yellow band..	11	

See footnotes at end of table.

RESTRICTED—Security Information

c. Data on Chemically Filled Munitions—Continued

	1	2	3	4	5	6	7
1	Munition	Status ¹	Agent and weight of filling (pounds unless otherwise indicated)	Weight of filled projectile (pounds unless otherwise indicated)	Approximate time for agent to burn or evaporate at point of release ²	Marking and color	Chemical efficiency (percent) ³
	<i>4.2-in mortar M8</i>						
36	Shell, gas, M2.....	S	CNB.....5.45	23.1	Several hrs. to 6 days.	CNB GAS; 1 red band.....	23
			CNS.....7.0	24.6	Several hrs. to 6 days.	CNS GAS; 1 red band.....	28
			CG.....6.25	23.8	5 to 10 min.....	CG GAS; 1 green band.....	26
			CK.....5.0	22.6	5 to 10 min.....	CK GAS; 1 green band.....	21
			H.....6.2	23.7	3 to 10 days.....	H GAS; 2 green hands.....	26
			HD.....6.0	23.5	3 to 10 days.....	HD GAS; 2 green hands.....	25
			HT.....5.75	23.5	Longer than H or HD.	HT GAS; 2 green bands.....	28
37	Shell, smoke, M2.....	S	WP.....7.5	25.1	About 1 min.....	WP SMOKE; 1 yellow band..	30
			PWP.....6.25	23.8	2 to 3 min.....	PWP SMOKE; 1 yellow band..	26
			FS.....7.5	25.1	Immediately.....	FS SMOKE; 1 yellow hand....	30
			FM.....7.5	25.1	Immediately.....	FM SMOKE; 1 yellow hand....	30
	<i>155-mm gun</i>						
38	Shell, gas, M104.....	S	H.....11.7	91.84	3 to 10 days.....	H GAS; 2 green hands.....	12
30	Shell, smoke, M104.....	S	WP.....15.6	96.24	Immediately.....	WP SMOKE; 1 yellow hand....	16
		SS	FS.....16.9	97.34	Immediately.....	FS SMOKE; 1 yellow band....	17

155-mm howitzer							
40	Shell, smoke, M110.....	S	WP.....15.6	95.64	Immediately.....	WP SMOKE; 1 yellow band.	18
		SS	FS.....16.9	99.69	Immediately.....	FS SMOKE; 1 yellow band...	17
41	Shell, smoke, BE, M1184.....	S	HO.....25.84	94.35	About 2 min.....	HC SMOKE; 1 yellow band..	20
			Colored.....18.14	87.4 ¹	30 sec to 4 min.....	1 yellow band; color indicated.	20
42	Shell, gas, CNS, M110.....		CNS.....13.8	92.8 ²	Several hrs. to 6 days.	CN GAS; 1 red band.....	14
43	Shell, gas, H, M110.....	S	H.....11.7	92.8 ²	3 to 10 days.....	H GAS; 2 green bands.....	14
44	Starter, fire, M1.....	S	NP thickened kerosene....0.05	.16	Approx. 13 min...	Yellow lettering.....	31

¹ S-standard; SS-substitute standard; LS-limited standard.

² Variable depending on the amount of agent released, type of agent, terrain, and meteorological conditions.

³ Ratio filling to total weight.

⁴ Color: red, yellow, green, violet. For air-ground and other signaling.

⁵ Estimated averages based on wide variations in zone weights.

RESTRICTED—Security Information*d. Chemical Ammunition Requirements**(1) Smoke shell.*

(a) Rounds per 100 yards per minute for combined screening and casualty effects using white phosphorous (WP).

	1	2	3	4	5
1	Wind direction	Following 6 o'clock	Head 12 o'clock	Flank 3 or 9 o'clock	Quartering
2	81-mm mortar.....	2.5	2	1.0	2
3	4.2-inch mortar.....	1.25	1	.5	2
4	75-mm gun and howitzer.....	12.0	10	4.0	8
5	105-mm howitzer.....	9.0	7	1.5	6
6	155-mm howitzer.....	3.0	2	.5	2

(b) Rounds per 100 yards per minute for screening only. To obtain number of rounds required, measure line to be screened in 100-yard increments. Multiply the number of increments by the quantity shown for the direction of the wind, multiply by number of minutes screen is to be maintained. Fire twice the number of rounds indicated during the first minute to establish screen.

Rounds per 100-yard Increments per Minute^{1 2 3 4}

	1	2	3	4	5
1	Wind direction	6 or 12 o'clock		3 or 9 o'clock ⁵	
		WP	HC	WP	HC
2	81-mm mortar.....	1.5	-----	0.8	-----
3	4.2-inch mortar.....	.7	-----	.4	-----
4	75-mm gun or howitzer.....	6.0	5.0	3.0	0.5
5	105-mm howitzer.....	4.0	3.0	1.5	.25
6	155-mm gun or howitzer.....	1.3	3.0	.5	.25
7	Smoke pots HC M-1 ⁶	-----	6.0	-----	3.0

¹ Table holds for winds up to 3 mph.

² For winds 3 mph to 10 mph multiply above results by 1.5.

³ For winds 10 mph to 15 mph multiply above results by 2.

⁴ Base ejection shell should be fired with combination time and superquick fuse M-54 to give an air burst 1 to 2 seconds less than that used for zero height or burst.

⁵ Quantities are for smoke curtains up to 1,000 yards. For curtains of 1,000 to 1,200 yards, multiply values by .9; for curtains in excess of 1,200 yards, multiply values by 0.8.

⁶ For smoke pots, the quantities indicated are the number of pots that must be kept burning. The smoke pots burn an average of 7 minutes; hence the indicated quantity will screen 100 yards for that period.

(2) *Land mines, mustard (H) or lewisite (L)*. Effect is obtained by contamination.

Mines Required

1	1	2
	Purpose	Mines required
2	Barriers.....	Four parallel lines of mines 25 yards apart with mines staggered at 10-yard intervals in each line.
3	Large areas.....	40 mines uniformly spaced per 100 by 100 yard square.
4	Along roads.....	One line of mines on each side of the road with mines staggered at 10-yard intervals along each line.
5	Demolitions.....	Mines placed in lines 5 yards apart at 5-yard intervals along each line. The approaches to the demolition should be contaminated using 40 mines per 100 by 100 yard square.

e. Chemical Land Mine Operations.

1	1	2	3	4	5	6
	Nature of task	Squad task	Platoon task	Company task	Average time ¹	
		1 truck (2¼-ton)	4 squads	12 squads	Time fuse or detonating cord	Wired for firing electrically
2	Barrier, 100 yards deep.....	800 yards....	3,200 yards..	9,600 yards..	4 hours.....	8 hours.
3	Road contamination.....	1,600 yards..	6,400 yards..	19,200 yards..	15 to 20 minutes. ²	2 hours.
4	Mines required.....	330.....	1,320.....	3,960.....		

¹ The time should be increased 50 percent for night work.

² Detonating cord laid from truck, mines placed on cord.

f. Capabilities of Heavy (4.2 inch) Mortar—Battalions. (Figures are based on normal loads of ammunition of one type shell.) Firing for area neutralization using high explosive shell, white phosphorus (WP) shell, or mixed HE-WP, requires 24 rounds per square. Based on prescribed loads, a platoon can neutralize 8 squares, a company 24

RESTRICTED—Security Information

squares, and a battalion 72 squares. Additional ammunition will only increase length of neutralization period.

	1	2	3	4
	Agent	Platoon	Company	Battalion
1	Nonpersistent gas.	Unit too small to use effectively.	Covers target area of 6½ squares with a surprise concentration. Gas also effective on unmasked personnel downwind on additional area at least equal to initial area covered.	Covers target area of 20 squares with surprise concentration.
2	Persistent gas.	Can contaminate 17 squares for 4 hours by firing 1 hour. ¹	3 times the capability of 1 platoon.	3 times the capability of 1 company.
3	Harassing gas (i. e., CNS).	Harasses for 4 hours 59 squares, or for 8 hours, 29 squares, etc. Gas remains effective for about 1 hour after firing ceases.	3 times the capability of 1 platoon.	3 times the capability of 1 company. The concentration should be maintained for at least 2 hours.
4	Smoke (WP).	Can maintain 500- yd screen for 60 minutes with adverse winds. Flank winds approximately double this capability.	3 times the capability of 1 platoon.	3 times the capability of 1 company.

¹ In woods, twice as much area can be neutralized.

² Based on battalion ammunition load. Any ammunition resupply increases capability proportionately.

Section V. SIGNAL COMMUNICATION

64. General

a. These data are intended for use as general guides only. The highly technical nature of signal operations and the effect upon them of varying security measures require that these data be applied only as recommended by the unit signal officer after modification according to local field conditions and in the light of the tactical situation.

b. For signal troop requirements in a typical army, see paragraph 48k (1) and (2).

c. For signal troop requirements in airborne operations, see paragraph 50.

d. For signal construction factors, see paragraph 263.

65. Users Served by the Signal System

The following users are usually provided service over the military signal system in a theater of operations:

a. *The Combat Zone Communication System.*

(1) Division.

(2) Corps.

(3) Army.

b. Communication Zone Communication System.

- (1) Army group.
- (2) Base, intermediate, and advance sections; depots and ports.
- (3) Intratheater tactical-administrative systems.

c. Communication Facilities as Required for—

- (1) Air defense.
- (2) Coordination of Army and Air Force activities, including facilities for the request of air support.
- (3) Coordination of Army and Navy activities.
- (4) Operation of military railways and pipelines.
- (5) Military police activities, including traffic control.
- (6) Personnel replacement systems.
- (7) Intelligence and counter-intelligence activities.
- (8) Military government and civil affairs.
- (9) Psychological warfare activities.
- (10) Press, public relations, and special service activities.
- (11) Guided missile installations and activities.
- (12) Clandestine and guerrilla warfare.
- (13) Interallied signal communication.
- (14) Signal countermeasures.
- (15) Meteorological service.
- (16) Signal security activities.

66. Means of Signal Communication

a. Military Messages Are Transmitted by:

- (1) Messenger, including routine and special foot, motor, and airplane messengers, officer couriers, and pigeons.
- (2) Wire circuits, including telephone, teletype, and facsimile.
- (3) Visual, including flags, panels, lamps, and pyrotechnics.
- (4) Sound, including whistles, sirens, bells, loud-speaker systems, and small-arms fire.
- (5) Radio, including continuous-wave, amplitude and frequency modulated equipment, radio-teletype, and voice, in all frequency ranges, and including radio-relay equipment making up part of a wire system.

b. Use of the Means of Signal Communication. Messenger, wire and radio are used for communication between division, corps, army, and higher headquarters. In addition to these means, visual and sound systems are used in air-ground signaling, in amphibious operations, for emergency communication within small units, and as warning signals.

c. Publications Governing Signal Communications.

- (1) Pertinent sections of the unit Standing Operating Procedures (SOP) set forth the general principles under which the unit signal system will operate. Usually the SOP is governed by

- the provisions of that of the next higher headquarters and, in turn, serves as a guide for that of subordinate headquarters.
- (2) Standing Signal Instructions (SSI) are published by the unit signal officer to provide permanent directions for the use of technical items of Signal Operation Instructions.
 - (3) Signal Operation Instructions (SOI) contain the specific technical directions for the operation of the various means of signal communication. It includes separate items providing such information as telephone directory code names and numbers, radio call signs and frequencies, unit codes and ciphers, and pyrotechnic signals. Because changes in items of SOI occur frequently, paragraph 5 of the field order specifies the current index.
 - (4) Joint Army-Navy-Air Force Publications (JANAP) and Allied Communications Publications (ACP) contain joint and combined instructions and methods and procedures pertaining to communications planning and operations.

67. Command Posts and the Axis of Signal Communication

a. Axis of Signal Communication. Each Army unit is provided with sufficient signal personnel and equipment to maintain communication to next subordinate headquarters under normal tactical conditions. For the proper performance of this mission, the axis of signal communications must be so planned that when the superior headquarters moves forward, it utilizes the wire circuits previously laid to the headquarters of a major subordinate unit.

b. Command Posts. Each army unit is provided with sufficient signal personnel and equipment for an adequate service within all echelons of the unit headquarters. The time required to complete the signal installation varies with the type and size of the headquarters. The following table provides data for a complete installation of the types of headquarters indicated and includes the time required for reconnaissance, completing the initial forward installation, closing out the rear installation, moving all equipment forward, and completing the forward installation. Essential facilities for the commander and general staff will be complete within approximately one-quarter of the total time.

	Division	Corps	Army	Army Group
Time required to complete the installation of signal facilities within a headquarters (WW II, ETO).	1 day.....	2 days.....	4 days.....	As determined by available troops.

c. Movement. Because each movement results in a temporary curtailment in operating facilities and because frequent movement results in decreased operating efficiency, command posts are moved as infrequently as the tactical situation allows. When it is necessary for the commander to maintain a headquarters close to the front in a rapidly moving situation, arrangements are made to provide minimum facilities for the Commander's Group. The following table represents an average of moves computed from After Action Reports from the European Theater for the month of April 1945: it represents a maximum figure at which operating efficiency was decreasing.

	Division	Corps	Army
Average movement of command post per month.....	11	7	2

68. Messenger

a. The rate of travel of various types of messenger is listed below; no consideration being given to traffic restrictions, climate, or weather:

Kind of messenger	Rate of travel in miles per hour	
	Day	Night
Dismounted (runner).....	3-5	2-4
Bicycle.....	6-10	4-8
Motor or motorcycle.....	25-40	15-30
Pigeon.....	30-45	
Aircraft.....	80 upwards	80 upwards

b. Each headquarters is furnished organic messenger facilities. The bulk of messenger traffic is carried by motor messenger. The capabilities of motor messenger service available to units is indicated below.

	Division	Corps	Army
Miles of route per month.....	7,000	30,000	90,000
Pouches and messages.....	17,000	50,000	150,000

c. The quantity of messages that can be transmitted by messenger and the speed of transmission are increased when messages are accounted for in the communication center by pouch instead of by individual message.

69. Wire

a. General. Wire communication networks are classified as approved or nonapproved circuits according to the degree of transmis-

sion security they afford against enemy tapping and interception. Relative security depends upon geographic location of the net, the tactical situation, local security measures, the type of equipment being used, and the type of conductor employed in the lines. Lines that possess a high degree of security may be classified as approved circuits for the transmission of restricted, confidential, or secret material in the clear. Lines that possess a low security rating require that all classified messages transmitted over them be encrypted in an appropriate system and are classified as nonapproved circuits.

b. Telephone. Each headquarters is provided with enough telephone facilities to satisfy normal operating requirements, provided that proper use is made of written messages for traffic not adapted to telephonic transmission. During World War II, unit switchboards in the European Theater handled the following average of calls:

	Division	Corps	Army	Army Group
Calls per day.....	2,000	5,000	12,500	18,000

c. Teletype. The following table shows the average number of teletype messages handled by various types of headquarters in the ETO during World War II.

	Division	Corps	Army	Army Group
Messages per month.....	750	4,000	11,500	28,000

d. Construction. For figures on permanent and semipermanent wire construction consult paragraph 263.

(1) Rates of wire line construction.

	Foot Troops	Reel Trucks	Signal Construction Battalion
Field wire.....	1½ mph/3-man team.	3-5 mph/6-man team.	-----
Spiral-4 cable (on existing support).....	-----	1 mph/8-man team	-----
Open wire (10-wire pole line).....	-----	-----	30 miles per week.

(2) S-4 cable and field wire laid to next subordinate headquarters by selected units during World War II in the ETO.

Miles per month of—	Division	Corps	Army
Field wire.....	450	-----	-----
Cable and field wire.....	-----	700	1,300
Open wire.....	-----	-----	500

- (3) Average rate of repair of wire lines over a 6-month period during World War II in the ETO by a well-trained division signal company.

	Daylight	Night	Average time out day and night
Elapsed time in minutes.	70	120	105

70. Radio

a. General. The amount of traffic that is handled by radio—exclusive of messages handled via radio-relay equipment installed as part of the wire net—depends upon the type of unit and the rate of displacement. In general, radio forms a stand-by means of communication during static conditions when its operation would provide information to enemy intercept and analysis; but in fast-moving situations when it is difficult to extend wire lines rapidly enough and when units disperse on a wide front, radio becomes a major means of communication.

b. Radio Traffic of Selected units in the ETO During World War II.

	Armored Division	Infantry Division	Corps	Army	Army Group
Average messages per month.	2,400	200	500	9,500	3,800
Average code groups or words per month.		35,000	85,000	163,000	650,000

71. Communication Center

a. Function. It is the function of the communication center to determine the most expeditious means of transmitting written messages and to operate the centralized transmission facilities. The figures in paragraphs 69c and 70b therefore apply to communication center operations.

b. Cryptographic Operations. Computed from After Action Reports of selected units in the ETO during World War II, and including messages sent by radio, teletype and miscellaneous means.

	Division	Corps	Army	Army Groups
Average code groups per month.	225,000	500,000	750,000	1,800,000

RESTRICTED—Security Information

c. Precedence. The nomenclature for classes of precedence in the following table, compile from After Action Reports in the ETO during World War II, has been changed to conform to present usage.

	Emer- gency	Opera- tional immediate	Priority	Routine	Deferred
Percentage of all messages (Army Hq) -----	Percent 8	Percent 30	Percent 23	Percent 39	Negligible.

d. Speed of Transmission. Computed to allow for operational signaling, repeating garbled groups, including address and signature, and receipting.

Means of transmission	Words per hour
Radiotelephone -----	80-120
Lamp -----	100
Telephone -----	100-150
Panel (code groups per hour) -----	15
Radiotelegraph -----	150-250
Teletypewriter (single line) -----	500-800
Teletypewriter (duplex) -----	1,000-1,500

Section VI. FIELD ENGINEERING**72. General**

These data are intended for use as general guides only. Their application should be varied to conform to local field conditions as required in each specific tactical situation, based on the recommendation, after reconnaissance, of the unit engineer charged with the task.

73. Roads and Bridges

a. Traffic Capacity. See chapter 7.

b. Load Capacity of Civilian Bridges. Peacetime design includes high safety factors for unusual loads and deterioration. As a guide for military operations, it may be assumed that the ordinary civilian bridge in good condition will carry twice the rated civilian capacity where restrictions are placed on the speed and spacing of vehicles and on the number of lanes in use. However, it is advisable to have bridge capacity analyzed by an engineer officer.

c. Road Capacity. The capacity of a road is limited usually by the capacity of the bridges thereon.

d. Marking Bridges and Vehicles.

- (1) Bridges are marked with class and width numbers. The bridge class number is the whole number which represents

the safe load-carrying capacity in tons of the bridge under normal conditions. The bridge width number is the clear width in inches between curbs, without regard to lanes. Bridges are marked or posted to the next lower whole number up to class 30, and to the next lower multiple of 5 for classes above 30; for example: the actual class number of a bridge theoretically classified as 21.75 would be 21, and class numbers for bridges theoretically classified as 32, 53, and 79 would be 30, 50, and 75, respectively. Bridge signs are circular in shape and show class and width numbers; the class numerals are twice the size, and are shown above, the width numerals. In addition, a rectangular sign is placed below the circular sign, stating the length of the critical span of the bridge or showing that the structure is a floating bridge.

- (2) Vehicles are marked with class numbers and with front width and side width numbers. The vehicle class number is the whole number which represents the effect a vehicle will have on a bridge in crossing it; the effect is determined from the gross weight of the vehicle and the weight distribution. The front vehicle width is the overall width of the vehicle in inches, plus 12. The side vehicle width number is the out-to-out tire or track width of the vehicle in inches. All standard Army vehicles are classified except trailers with a gross weight of less than one ton and other types of vehicles with a gross weight of less than 3 tons. All *single* vehicles in excess of 3 tons gross weight, carry front and side signs; all *trailers* in excess of one ton gross weight, carry a side sign. The front sign shows the class number over the front width number, while the side sign shows the class number over the side width number. The front sign of a *combination* vehicle shows the class and front width numbers of the combination, with the letter "C" above the class number. The side signs of combinations show the class and side width numbers of each part of the combination. A *towed vehicle and its tower* are considered to be separate vehicles unless both are in a given span at the same time and the distance between the two is less than 30 yards, in which case they are considered to be a combination vehicle. When considered as a combination vehicle, the class of the combination is the sum of the classes of the separate vehicles, and is shown on a temporary front sign, together with the front width number of the wider vehicle. Detailed information is contained in TC 9, 1952.

74. River Crossing Equipment

a. Distribution of Floating Equipment.

	1	2	3	4	5	6
1	Item	Engr C Bn Div	Armd Engr Bn	Abn Engr Bn	Engr Pon Brg Co	Engr Float Brg Co
2	Boat, assault, M2.....	16	42	23		70
3	Boat, recon, pneumatic, 2-man.....	13	18	15		
4	Boat, recon, pneumatic, 5-man.....				1	1
5	Boat, utility, powered, 19-ft.....				1	
6	Boat, utility, powered, 27-ft.....		2	1	3	1
7	Bridge fixed and floating, airborne division, 50-ton (276 ft. 8 in.).			1		
8	Bridge, floating, M4 (428 ft.).....				1	
9	Footbridge, M1938 (432 ft.).....	Available in Army Engr C I II and IV Dep.				
10	Ferry set No. 1, infantry support.....	Available in Army Engr C I II and IV Dep.				
11	Raft, infantry support.....	2		2		
12	Bridge, floating, treadway, steel, widened (288 ft.).		2			3
13	Bridge, fixed, steel, widened for short spans (216 ft.).	1				

b. Characteristics of Boats and Rafts.

(1) Assault and storm boats.

1	Boats	Engr crew, number of men	Various maximum loads per boat, in addition to crew	Maximum stream velocity fps	Time in min for round trip across stream with width of		
					300 ft.	500 ft.	1,000 ft.
2	Single assault boat M2 w/9 paddles.	3	{ 12 riflemen with ind equip.	4	4	6	10
3			1 rifle sqd.				
4			1 hv MG sqd w/gun and 13 boxes ammo. .				
5			1 81 mm mortar sqd w/mortar and 50 rounds ammo.				
6			2 LMG sqds w/guns and 20 boxes ammo. .				
7			2 60 mm mortar sqds w/mortars and 72 rounds ammo.				
8			1 75 mm rifle sqd w/rifle and 70 rounds ammo.				
9			1 57 mm rifle sqd w/rifle and 100 rounds ammo.				
10	2-assault boat ponton w/out board motor.	2	{ 22 riflemen with ind equip.	7	-----	4	6
11			{ 15 riflemen with ind equip.	9			
12	Storm boat.	2	{ 7 riflemen with ind equip.	11	-----	3	4
13			1 hv MG sqd w/gun and 9 boxes ammo. .				
14			1 81 mm mortar sqd w/mortar and 24 rounds ammo.				
15			1 LMG sqd, 2 extra men, gun and 10 boxes ammo.				
16			1 60 mm mortar sqd, 2 extra men, gun, and 36 rounds ammo.				

(2) Rafts

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1	Type of raft	Number of pontoons or floats	Length		Construction time ^b	Construction party	Operating crew	Class and number of power units needed ^a								Type of power unit required	Transportation required (for raft equipment only. Additional needed for construction equipment and troops).		
			Over-all incl ramps	Available for loading ^a				Normal crossing				Risk crossing					Number of units	Unit	
								Stream velocity FPS				Stream velocity FPS							
								3	5	7	9	3	5	7	9				
2		3	38'-0"	24'-0"	10 min			1	2	3		1	2	3	4	Outboard motors.	1	2½T truck w/pole tlr.	
3	Infantry support.	5	50'-0"	35'-9"	15 min	1 plat	1 sqd	8	8	4	10	9	5	2					
4		7	62'-0"	47'-9"	20 min			13	10	5	15	13	8	3					
								13	21	21	8	13	16	23	23		10	16	5	6
5	Widened steel treadway.	4	64'-11½"	42'-0"	30 min	1 plat	1 sqd	1	1	1	2	1	1	1	2	27' bridge erection boats.*	3	5T bridge trucks.	
6		5	76'-11½"	48'-3"	45 min					35	35	35	20	45	35		40	25	
								1	1	1	2	1	1	1	2				
								45	45	45	25	50	50	50	30				
7		4						1	1	1	1	1	1	1	1	27' bridge erection boats.*	5		
8	M4	6	87'-¾"	51'-8"	1 hr	1 plat	1 sqd	55	55	55	55	60	60	60	60			6	5T DP trucks.
9		7						1	1	1	2	1	1	1	2			7	
								90	90	90	85	95	95	95	95				
10	Airborne division 50-ton.	4	87'-¾"	51'-8"	1 hr	1 plat	1 sqd	1	1	1	2	1	1	2	3	27' bridge erection boats.*	4	5T bridge trucks.	
11		6	88'-¾"	53'-4"	1½					35	35	30	20	45	45		40	25		5
								1	1	2		1	1	2	3				
								55	50	45		65	60	50	15				

Key



Number of power units needed

Capacity in tons (one or more vehicles)

Key



Number of power units needed

Single vehicle capacity

Double vehicle capacity

(Vehicles should be approximately equal in weight)

1		2	3	4
1	Operating characteristics of rafts	Stream width feet		
		300	500	1,000
2	Number of round trips per hr in currents of 5 FPS in daylight (reduce 50% for night or adverse conditions).	10	6	4
3	Number of rafts which can be used efficiently at one site.....	1	2	3

a Measured from outside edge to outside edge of end pontoons or floats.

b Construction time includes unloading and construction only, does not include preparation of landing sites or construction of access roads.

c Capacities are based on loading rafts with center of gravity of loads 6" downstream from a of raft and on properly inflated floats.

d One 19' bridge erection boat per raft, in current of 9 FPS.

e One 19' bridge erection boat may be used in currents not over 5 FPS. In currents of 5 FPS and over, normally two 19' bridge erection boats may be substituted for one 27' boat.

f Extreme caution is required in loading and unloading vehicles weighing more than 70 tons.

Note.—The 19- and 27-foot bridge erection boats replace the 18- and 25-foot utility boats.

RESTRICTED

185

RESTRICTED—Security Information

74

c. Characteristics of Standard Floating Bridges.

	1		2		3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
1	Type of bridge		Transportation required ^a		Construction time in hours ^b				Construction party ^c		Maintenance crew	Capacity in tons ^d																Traffic capacity and vehicular distance for safe crossings in daylight (except as otherwise noted) ^e	
					Stream widths							Safe crossing ^g (posted capacity)				Caution crossing ^f				Risk crossing ^h									
												Stream velocities in feet per second																	
					150 ft	250 ft	500 ft	1,000 ft				3	5	7	9	11	3	5	7	9	11	3	5	7	9	11			
2	Foot-bridge M1938 (432 ft.).		1—2½t truck per 144 ft. of bridge.		1 4	1 3	1 2	-----	1 Plat.-----	1 Sqd.	Safe-----		Un-safe		-----		-----		-----		-----		-----		-----		Day: 75 men per minute. Night: 40 men per minute at normal 2-pace distance. ^j		
3	M2 Assault Boat Bridge	Normal construction.	1—2½t truck and 1 pole tlr per 36 ft. of bridge.		1	1½	2½	-----	1 Plat.-----	1 Sqd.	8	6	5	-----	-----	8	6	5	-----	-----	9	7	6	-----	200 vehicles per hour; 90-ft. distance between vehicles.				
4		Reinforced construction.	1—2½t truck and 1 pole tlr per 24 ft. of bridge.		1½	2	3	-----	1 Plat.-----	1 Sqd.	13	9	7	-----	-----	13	11	8	-----	-----	14	12	0	-----					
5	Widened steel trestle bridge.		1—5 ton Brg truck per 24 ft. of bridge.		2½	4	7	12	1 float br co plus 1 combat co.	1 Sqd.	50	50	40	30	15	50	50	45	35	20	55	55	50	45	30				

6	M4 bridge.....	1—5 ton Dump truck per 15 ft of bridge (normal const).	3	5	8	14	1 ponton br co plus 1 or 2 combat cos.	1 Sqd.	55 95	55 05	55 95	45 70	30 40	60 100	60 100	60 100	50 85	40 55	65 105	65 105	55 100	45 70	400 vehicles per hour; 100-ft. distance between vehicles.
7	Airborne division, 50-ton. ^a	5—5 ton Brg trucks per 60 ft. of bridge.	4	6	-----	-----	1 br plat plus 1 combat co.	1 Sqd.	45	35	30	10	---	50	40	35	15	---	55	50	45	25	---
8	Class 60 floating bridge.	1—5 ton Bridge truck per 15 ft. of bridge.	1½	2½	4½	8½	1 hrg plat, plus 1 combat plat.	1 Sqd.	60	60	55	50	18	65	65	60	55	30	75	75	70	65	45

^a Transportation for bridge equipment only. Additional needed for any construction equipment required, and for troops.

^b Includes unloading and construction only in daylight. Does not include access roads, assembly sites, abutments or anchorages.

^c Average for trained troops and continuous daylight construction. Allowances are required for specific situations.

^d Based on abutments at levels within 12 inches of floating bridge deck level.

^e Vehicle anywhere on width of bridge deck. Speeds—15 mph recommended, up to 25 mph permitted.

^f Center of vehicle on bridge centerline. Maximum speed 8 mph. Vehicle spacing 150 ft. No sudden stopping or acceleration, or gear shifting.

^g Center of vehicle within 0" of centerline and with guide. Maximum speed 3 mph. One vehicle on bridge. No stopping, braking or gear shifting.

^h Traffic capacities are for all traffic moving forward or rearward.

ⁱ Normal construction

Reinforced construction

^j Use 2-pace distance for 3 fps only; 1-bay distance for 4 and 5 fps; 2-bay distance for 6 and 7 fps.

^k These classes do not govern the crossing of M4A3, M16, M45, and M46 tanks. These tanks can make normal crossings on the M4A2 bridge for current velocities up to 5 fps even though their class numbers exceed 35. These exceptions do not apply to other bridges or to other vehicles whose class numbers are greater than 35.

d. Fixed Highway Bridges.

1	2			3								4	5	6
1	Fixed panel bridge			Panel bridge Bailey type, M2								Semipermanent steel fixed-bridges ^{1 2}		
2	Length of one unit			130 feet (double-double)								30-foot I-beam span	60-foot I-beam span	90-foot truss span
3	Posted capacity in tons	Span (ft.)	Type T6, width 13'6"		Span (ft.)	Type								
			Single truss	Double truss		Single-single	Double-single	Triple-single	Double-double	Triple-double	Double-triple			
			Tons	Tons		Tons	Tons	Tons	Tons	Tons	Tons			
	120				30	40								
					40	32								
					50	28	80							
	135	60			60	26	67							
					70	22	64							
	165				80	18	51	80				50 tons.....	50 tons.....	50 tons.
					90	13	44	62						
	195			60	100	10	31	52	75					
					110		23	40	64	80				
					120		18	34	50	70				
					130		13	23	40	57	80			
					140		10	18	31	48	67			
					150			13	23	40	65			
					160			10	19	31	56			
					170				13	23	50	80		
					180				10	18	40	57		
					190					12	31	50		
					200						23	40		
					210						18	29		

RESTRICTED

RESTRICTED—Security Information

4	Packaged weight of unit in short tons. ¹			100	Steel 6.5..... Lumber 6.4....	Steel 22.9..... Lumber 12.4....	Steel 31.0. Lumber 18.9.
5	Packaged cubage of one unit in ship tons. ²			145	Steel 7.5..... Lumber 8.0....	Steel 20.3..... Lumber 15.7....	Steel 48.6. Lumber 22.1.
6	Issue.....	Class IV restricted issue.	Class IV, 42 2½-ton trucks.....		Class IV restricted issue.		
7	Transportation for one unit.				2 8-ton full flat bed trailers w / p r l m s movers 450.	4 8-ton full flat bed trailers w / p r l m o movers 1,000.	7 8-ton full flat bed trailers w / p r l m s movers 2,000.
8	Man-hrs per unit. ⁴			600			

¹ This equipment is not standardized and has been declared excess; however, specifications are being maintained.

² With one line of traffic.

³ Values are approximate only and are subject to change due to revised packaging and changes in components of sets.

⁴ Does not include time for preparation of approach roads, assembly sites, and elaborate abutments. Adjustments must be made for specific site conditions.

75. Explosives (carried only in organic demolition sets) *

<i>Unit</i>	<i>Pounds</i>
Engineer C Battalion (Division)-----	12,570
Engineer C Battalion (Army)-----	10,800
Headquarters & Service Company-----	(5,450)
Lettered Company (ea)-----	(1,780)
Armored Engineer Battalion-----	13,200
Lettered Company (ea)-----	(2,050)
Airborne Engineer Battalion-----	12,754
Headquarters & Service Company-----	(4,996)
Lettered Company (ea)-----	(2,586)
Headquarters & Headquarters Company, Infantry Battalion	50
Reconnaissance Company (Division)-----	300

76. Field Fortifications

a. Priority of Work. The order in which the various defensive measures are to be executed is expressed in orders in the form of priorities. The assignment of priorities does not prevent simultaneous work on several tasks. After the location of combat emplacements has been fixed, the normal priority is—

- (1) Clearing fields of fire and removal of objects masking observation.
- (2) Laying of antitank mine fields and execution of important demolitions such as bridges.
- (3) Providing for adequate signal communication and observation systems.
- (4) Preparing individual shelter and emplacement of weapons.
- (5) Preparing obstacles (other than mine fields) and other demolitions.
- (6) Preparing routes for movement of reserves and for supply and evacuation.

*Additional may be carried as required.

RESTRICTED—Security Information

b. *Works* (figures are for daylight; for work at night, increase labor by 50 percent).

(1) *Time and labor for constructing entrenchments.*

	1	2	3	4
1	Type of emplacement	Excavation (cu ft)	Number of men working	Approximate time (hours)
2	Shallow connecting trench (10-yard section).....	150	6	1
3	Standard trench (10-yard section with one firing position) ..	515	6	6½
4	Special trench for artillery or rear-area installations (2-yard section).	48	1	2½
5	Prone shelter.....	24	1	1
6	1-man fox hole.....	35	1	1½
7	2-man fox hole.....	60	2	2½
8	3-man V-shaped fox hole.....	189	3	5
9	3-man Y-shaped fox hole.....	237	3	6

(2) *Revetment estimates.*

	1	2	3
1	Type	Quantity of material necessary	Time for construction (man-hours)
2	Sandbag.....	Single row of stretchers for small revetments. Alternate headers and stretchers. Fills, parapets, and breastworks.	16 per 100 sq ft (includes time for filling bags).* 32 per 100 sq ft (includes time for filling bags).* 20 per 100 cu ft (includes time for filling bags).*
3	Issue material.	Burlap, wire mesh, wire, and pickets.	Burlap—100% of area to be revetted..... Pickets: Soft soil—1 every 1½ ft. Hard soil—1 every 6 ft. Wire—20 ft for every picket. Wire mesh—100% of area to be revetted.
4	Natural material.	Brush, wire, and pickets.	Brush—Dependent upon nature of foliage or brush. Pickets: Soft soil—1 every 1½ ft. Hard soil—1 every 6 ft. Wire—20 ft for every picket.

*Does not include carry of more than 50 ft.

(3) *Clearing.* Four man-hours of labor are required for clearing 100 square yards of brush and a few trees up to 12 inches in diameter; for brush only, 2 man-hours.

(4) *Excavation and camouflage data for emplacements.*

	1	2	3	4	5
	Weapon	Type of emplacement	Area to be camouflaged (ft)	Excavation (cu ft)	Man hours required to construct in medium soil
2	Rifle.....	Fox hole.....	10×10	37	1½
3	Automatic rifle.....	Fox hole.....	10×10	37	1½
		Pit-fox hole.....	10×10	125	1
4	Rocket launcher.....			87	4½
		Pit.....	5×5	50	3
5	Machine gun, light cal .30.....	Horseshoe.....	15×15	123	7
		2-fox hole.....	12×12	74	3
6	Machine gun, heavy cal .30.....	Horseshoe.....	15×18	140	8
		3-fox hole.....	15×15	111	5
7	60-mm mortar.....	Pit.....	14×14	70	4
8	81-mm mortar.....	Pit.....	16×16	108	6
9	57-mm recoilless rifle.....	Horseshoe.....	12×15	125	6¾
10	75-mm recoilless rifle.....	Horseshoe.....	16×16	160	7½
11	105-mm howitzer M3.....	Circular.....	29×29	430	22

¹ Without fox holes.

² With fox holes.

(5) *Barbed-wire obstacles.*

(a) *Estimating requirements.* The minimum length of tactical wire entanglements for a defensive position is one and one-quarter times the frontage; minimum protective wire is five times the frontage. The length of tactical wire entanglements for a deliberate defense is five times the frontage; protective wire is six times the frontage.

RESTRICTED—Security Information*(b) Wire entanglement materials for 300 yards of entanglement.*

	1	2	3	4	5	6	7	8	9	10
1	Type of entanglement	Pickets				Barbed wire 400 yd 115 lb reels ¹	Con- cer- tinas	Staples made of 1/2" round drift pins	Lbs of mate- rials per lin yd of en- tan- gle ment ²	Man hours to erect 300 yds of en- tan- gle ment ³
		Extra long	Long	Medi- um	Short					
2	Double-apron, 4- and 2- pace.	-----	91	-----	182	12-13	-----	-----	10	54
3	Double-apron, 6- and 3- pace.	-----	61	-----	122	11-12	-----	-----	7	45
4	High-wire (less guy wires).	-----	181	-----	-----	15-18	-----	-----	12	72
5	Low-wire, 4- and 2-pace.	-----	-----	91	182	9	-----	-----	7.5	45
6	Four-strand fence.	-----	91	-----	2	3 1/2-4	-----	-----	4	18
7	Double-belt expedient concertina.	-----	92	-----	4	2	4 90	270	14	36
8	Triple-belt expedient concertina (pyra- mided).	46	92	-----	6	3	4 135	270	21	90
9	Triple-belt standard Dannert concertina.	-----	146	-----	4	2	54	-----	15	27

¹ Lower number of reels applies when screw pickets are used; higher number when U-shaped pickets are used. Add difference between these 2 to the larger number when wood pickets are used.

² Average weight when any issue metal pickets are used.

³ With exception of triple-belt concertina, man-hours are based on use of screw pickets. When driven pickets are used, add 20 percent to man-hours. With experienced troops, reduce man-hours by 1/3. Increase man-hours by 50 percent for night work.

⁴ Based on concertinas being made up in rear areas and ready for issue. One expedient concertina opens to 20-foot length (as compared with 50 feet for a commercially made Dannert concertina) and requires 100 yards of stranded barbed-wire, also small quantities of No. 10 and No. 16 smooth wire for ties.

(c) Wire materials for making expedient concertinas for 300 yards of entanglement:

Type of concertina	Standard barbed-wire 400-yd reels	No. 10 wire 100-lb. coils	No. 16 wire 10-lb. coils
Double-belt.....	23	1	1
Triple-belt.....	34	1	1

77. Mine Fields.

For data pertaining to mine fields, see FM 5-32 and TC 34, 1952.

78. Fordable Depth of Water ¹

Type unit	Depth (feet)
Infantry on foot.....	3½
Horse cavalry.....	4½
Trucks and truck-drawn artillery.....	² 2
Light tanks.....	² 1-3
Medium tanks.....	² 2-4
Heavy tanks.....	² 4-6

¹ Moderate current, hard bottom.

² May be materially increased by suitable waterproofing.

79. Load Bearing Capacity of Ice.

The strength of ice varies with the structure of the ice; the purity of the water from which it is formed; the cycle of formation, or freezing, thawing, and refreezing; temperature, snow cover; and water currents. The sustaining capacity of ice is not definitely determined but experience and tests provide working-capacity figures for good quality ice of varying thicknesses as given in the table below.

Load	Minimum thickness of ice (inches)	Minimum in- terval between tracks, or dis- tance between elements (feet)
Single rifleman on skis or snowshoes.....	1½	16
Infantry columns, single horses, motorcycles, unloaded sleds.....	4	33
Single light-artillery piece; ¼-ton truck, 4 x 4.....	6	49
Light artillery, passenger cars, medium 1½-ton trucks, light total load of 3 tons.....	8	65
2½-ton trucks, light loads.....	10	82
Closed columns of all arms except armored force and heavy artillery.....	12	98
Armored scout cars, light tanks.....	14	115
20-ton vehicles.....	16	131

CHAPTER 5

LOGISTICS—SUPPLY

Section I. GENERAL

80. Use of Logistical Data

The logistical data contained in this and the succeeding four chapters (Logistics—Evacuation and Hospitalization; Logistics—Transportation; Logistics—Service; Logistics—Management) are of the type suitable for first approximation planning. They are, in the most part, based on World War II experience, modified to reflect changes in concept and organization. Detailed logistical planning should be based upon the references listed in the foreword.

81. General Supply Factors

a. The following broad general factors are useful for very long-range planning where the figures in the balance of this chapter are too detailed. They should be used only in forming rough estimates in logistical planning or as “rule of thumb” checks against the calculations of technical planners. The over-all theater factors given below include only military requirements and are based on the following ratios between ground and air: For each division slice of 40,000 men there will be two air wing slices of 5,000 men each. (See par. 124*a.*)

b. Initial Equipment and Initial 30 days of Maintenance.¹

	1	2	3	4	5	6	7	8	9
	Item	Total requirement per man in the theater (Army plus Air)			Shipped from ZI ²			Procured in TOPNS ³	
		Measure tons per man	Short tons per man	Long tons per man	Measure tons per man	Short tons per man	Long tons per man	Short tons per man	Long tons per man
1									
2	Initial equipment.....	4.0	1.50	1.33	4.0	1.50	1.33	-----	-----
3	30 Days' Maintenance								
4	Dry cargo.....	1.0	.68	.60	.8	.54	.48	.14	.12
5	Bulk POL.....	.4	.28	.25	.4	.28	.25	-----	-----
6	Total.....	5.4	2.46	2.18	5.2	2.32	2.06	.14	.12

¹ For use as broad initial planning factors. Does not include tonnages involved in build-up of theater reserves.

² Applicable only in situations where procurement in the theater of operations is feasible.

³ Bulk petroleum normally is not expressed in measurement tons. This figure is provided in this table merely for the purpose of comparison with dry cargo.

Section II. CLASS I SUPPLY

82. Characteristics of Standard Rations

1	2	3	4	5	6	7
	Packaging information			Average weight per ration including packing (lb.)	Average weight per ration unpacked (food only) (lb.)	Remarks
	Number rations per package (case)	Weight per package (lb.) (case)	Volume per package (cu. ft.) (case)			
1	Type ration					
2	Field, Type A.....			6.0	5.2	This is the basic field ration. Components, weight, and volume vary. Normally contains maximum of fresh meat, dairy products, fruits, and vegetables, and other perishables (0.183 cu. ft. per ration).
3	Operational, Type B.....			5.3	4.3	Same as field ration with nonperishable items substituted for perishable (0.1269 cu. ft. per ration).
4	Small Det, Type "5 in 1"....	5	27	0.8	5.8	3.7 Nonperishable precooked or prepared food which may be eaten hot or cold. Five separate menus.
5	Individual combat, Type C-4.	6	40.0	1.1	6.6	4.1 Nonperishable precooked or prepared food which may be eaten hot or cold. Recommended duration of use: 2 days maximum. Five separate menus.
6	Food packet, individual assault IA-1.	24 packets.....	39	1.1		Nonperishable precooked or prepared food which may be eaten hot or cold. Packaged so as to be carried by the individual. Recommended duration of use: 1 day. Based on tentative specifications, not a complete ration.
7	Sundries pack.....			.47	.40	Composed of essential toilet articles, tobacco, and confections necessary to the health and comfort of troops.
8	Spice pack, kitchen.....	Supplement 1,000 rations	40.0	1.2		Provides spices and condiments for 1,000 <i>field or operational</i> Type B rations.
9	Special items pack, hospital (hospital supplement ration).	25	50.0	1.4	2.0	Composed of fruit juices, soups, milk, etc., required as special nourishment for hospital patients.
10	Special items pack, first aid station (beverage pack, aid station).		40.0	1.0		Composed of fruit juices and similar liquid diet items required for patients.
11	Grain.....				10	Average for horses and mules. Reduce by 50 percent on ship.
12	Hay.....				14	Average for horses and mules.
13	Salt.....				1/4	Average for horses and mules.
14	Dog.....				2	Average for 50-lb. dogs.

RESTRICTED—Security Information

83. Time Elements in Class I Supply

While the figures shown in this table are an approximate *average* for combat conditions, they should be used only as a guide when actual experience is lacking.

	1	2	3
	Work	Daylight (min.)	Dark (min.)
2	Unload rations for one division at Class I distribution point and prepare for distribution to regiments or separate battalions	120	150
3	Distribution of Class I supplies to regiment by higher echelon at one distribution point	30	30
4	Distribution of Class I supplies to separate battalion by bigger echelon or similar unit	15	15
5	Preparation of one day's Class I supplies for issue at regimental or battalion Class I distribution point	80	60
6	Physical distribution by regimental supply agencies of one field ration (transfer of loads) to kitchens	15	20
7	Kitchens to be taken off trucks, set up, and ready to begin cooking (or vice versa)	20	20
8	Division of one ration into three meals at kitchens	15	20
9	Kitchens to cook and prepare for serving a hot meal, starting with a hot kitchen	120	150
10	Kitchens to prepare a cold noon meal. The issue of this meal to take place usually coincident with serving of breakfast. (Included in item next above) ..	60	90
11	Serving a hot meal to troops from a kitchen truck when majority of men are served at the truck	45	60
12	Serving a hot meal to troops by means of carrying parties (assuming the kitchen truck not farther than 1,000 yards in rear of the company)	90	120

Section III. CLASSES II AND IV SUPPLY—DIMENSIONS AND WEIGHTS

84. Items of Chemical Equipment

	1	2 ¹	3	4	5	6 ²	7
	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—Inches)				
2	Truck	Trk, cml svc, M1	310	88	99	5.6	38.8
3	.....	Apparatus, decon, power-driven, truck-mounted, M3A2	254	87	96	5.6	29.2
4	Trailer	Trailer, cml svc, M1	242	88	99	2.7	28.2
5	.....	Trailer, cml handling, M2	210	89	32	2.5	8.6
6	Equipment	Set, equip, maint, and rep, M1				3.5	9.0
7	.....	Repair set, Cml C equip, M9				2.0	5.6
8	.....	Svc unit, flame thrower, combat veh, M4				8.3	41.4
9	Laboratory	Lab, base, Cml C, M2				9.0	33.9
10	.....	Lab, mobile, Cml C, M3				1.2	3.4
11	.....	Impregnating, plant, clothing, M2				35.9	178.4

¹ Items exceeding 1 short ton, uncrated.

² Weights of vehicles shown in column 6 are weights of vehicles not loaded.

85. Items of Engineering Equipment^{1 2}

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—inches)				
2	Equipment...	Auger, earth, skid Mtd, gasoline engine driven.	228	96	108	2.5	-----
3	-----	Angledozer, Trac Mtd (35 hp).....	143	78	62	7.7	10.0
4	-----	Compressor, air, Trk Mtd, gasoline engine, 105 cfm.	254	90	93	7.1	35.5
5	-----	Compressor, air, Tlr Mtd, rubber tired, diesel engine driven, 315 cfm.	153	63	91	4.2	13.0
6	-----	Crane, Trk Mtd, ¾-cu yd.....	453	96	144	23.4	61.2
7	-----	Crane, Trk Mtd, ¾-cu yd.....	424	96	128	13.2	76.0
8	-----	Crane, revolving, crawler Mtd, ½ cu yd.	487	96	120	13.0	75.0
9	-----	Crane, Trac operated, non-revolving 20-ton, 20-ft boom.	344	111	134	3.7	74.0
10	-----	Distributor, hltuminous, Tlr Mtd, 1,250-gal.	194	92	102	5.3	26.3
11	-----	Ditching machine, ladder type, crawler Mtd, gasoline engine driven, 8-ft depth- 18- to 24-inch wide.	180	134	190	11.9	66.0
12	-----	Grader, road, Mtz, diessel engine driven, 12-ft mold-board.	360	103	91	4.3	38.6
13	-----	Grader, road towed type, leaning wheel, hand controlled, 10-ft mold-board.	382	118	96	6.4	64.0
14	-----	Grader, road towed type, leaning wheel, hand controlled, 6½-ft mold-board.	144	72	66	0.9	10.0
15	-----	Luhricator, Tlr Mtd.....	147	69	69	1.5	10.0
16	-----	Mixer, concrete, gasoline engine driven, 14-cu ft, Tlr Mtd.	120	108	120	3.6	23.0
17	-----	Power plant, SKW Tlr Mtd.....	144	72	72	1.5	11.0
18	-----	Roller, road, gasoline engine, 3-wheel, 10-ton.	207	76	120	10.0	27.0
19	-----	Roller, road, sheepsfoot w/removable feet.	128	56	69	1.5	5.2
20	-----	Rooter, road, cable operated, 5-tooth.....	204	100	67	3.7	24.0
21	-----	Scraper, road, towed, cable operated, 8-cu yd.	355	118	119	7.5	72.0
22	-----	Trac crawler type, diesel engine driven, 35 to 40 DBHP, standard with hull-dozer tilting (D-4).	143	78	62	7.8	10.0
23	-----	Trac, diesel engine driven, 61 to 90 DBHP, standard with hulldozer tilting (D-7).	216	146	122	18.0	63.0
24	-----	Trac, wheeled, rubber tired, gasoline engine driven, 30 DBHP, standard.	108	66	75	3.0	8.0
25	-----	Trac, rubber tired, gasoline driven w/hydraulic Contl 23 DBHP.	123	58	58	1.7	6.0
26	-----	Trac, crawler type, gasoline driven, 20 DBHP, standard, complete, w/hydraulic Contl, hulldozer and winch.	147	83	72	2.2	13.0
27	-----	Trac, crawler type, Diesel engine driven 30-40 DBHP, rigid, w/loader hucket, cable operated, front Mtd, ¾ cu yd and bulldozer tilting.	176	80	124	8.1	25.0
28	-----	Welding Equip, set No. 1, electric arc, 300 amp, Tlr Mtd.	144	72	72	1.6	11.0

¹ Items exceeding 1 short ton, uncrated.² Weights of vehicles shown in column 6 are weights of vehicles not loaded.

85. Items of Engineering Equipment—Continued

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—Inches)				
29	Boats.....	Boat, 25-ft power utility.....	314	104	48		22.0
30		Boat, assault, M2, with paddles and canvas cover (6 per package).	160	64	25	2.0	3.7
31		Boat, storm.....	203	81	25	2.0	5.9
32	Bridges.....	Br, foot M-1938 (482-ft).....				9.6	
33		Br, ponton, M4A2 (695-ft).....				295.8	750.0
34		Br, floating, M4 (428-ft).....				232.8	1638.0
35		Br, fixed, steel panel, Bailey-type, M2.....				55.0	140.0
36	Ferries.....	Raft set, No. 1, Inf. spt.....				4.8	18.0
37	Electric light..	Electric lighting Equip, set No. 3, 3KVA.....				1.0	
38		Electric lighting Equip, set No. 4, 5KW.....				1.5	
39	Trucks.....	Trk, cargo, treadway, 6-ton, 6 x 6, 4DT w/winch.	393	100	108	13.3	58.0
40	Plants.....	Crushing and screening plant, semi-trailer Mtd, 25-cu yd/hour.	390	96	126	19.7	68.4
41		Saw mill, 60-in, 1,200 FBM/hour 4 ft x 7 ft saw table.				19.0	40.0
42	Miscellaneous.	Pioneer Equip, set No. 2.....				1.0	2.1
43		Pipe line Equip, set for 2½-ton truck.....				2.6	7.2
44		W Sup Equip, set No. 4.....				2.1	4.3
45	Trailer.....	Tlr, fall bed, 8-ton.....	298	102	57	4.5	25.4
46		Shop Equip, Mtz, utility.....	264	96	120	8.3	44.0
47	Semitrailer....	Low bed, front loading, 20-ton, w/o dolly.	424	115	79	12.0	55.7

86. Items of Medical Equipment

a. Special Purpose Vehicle.

1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimension—inches)				
2	Truck.....	Dental Lab, 2½-ton, 6 x 6.....	256	92	118	8	42
3	Truck.....	Med Lab, 2½-ton, 6 x 6.....	256	92	118	8	42
4	Truck.....	Surg, Armored Force, 2½-ton, 6 x 6.....	273	96	115	8.1	43.7
5	Truck.....	Optical Repair Shop, mobile.....	256	88	110	7.6	36

b. Major Medical Service Unit Assemblies.

Cons. Comb.	Item Nos.	Type unit assembly	T/O & E	Weight (lbs.)		Cube		No. packages		No. carloads		No. line items	
				Med. only	Comp. T/O & E	Med. only	Comp. T/O & E	Med. only	Comp. T/O & E	Med. only	Comp. T/O & E	Med. only	Comp. T/O & E
SAJ.....	9-314-850	Mobile Army Surgical Hosp., 60-bed.....	8-571A	50,080	88,276	3,305	5,249	448	793	2	3	1,314	1,487
SGN.....	9-195-800	Evacuation Hosp, Semi-Mob., 400-bed.....	8-581	83,655	228,007	5,189	13,410	1,045	2,097	2	5	3,065	3,314
SGM.....	9-196-450	Field Hospital, 400-bed.....	8-510	107,638	221,482	7,006	12,727	1,170	2,126	2½	6	4,048	4,597
SGY.....	9-195-830	Evacuation Hosp., 750-bed.....	8-580A	154,911	333,415	10,005	18,661	1,528	3,303	4	8	3,881	4,017
SGG.....	9-551-800	Station Hosp., CZ, 25-bed.....	8-561	18,600	38,200	1,100	2,010	90	200	LCL	1	1,022	1,200
SGF**.....	9-551-810	Station Hosp., CZ, 50-bed.....	8-562	28,905	62,500	1,967	4,039	289	566	1	2	1,463	1,778
SGE**.....	9-551-830	Station Hosp., CZ, 100-bed.....	8-563	64,291	109,990	4,300	7,323	462	859	2	3	1,735	2,073
SG3/**.....	None	Station Hosp., CZ, 200-bed.....	8-564	77,752	120,000	5,225	7,500	790	1,600	2	3	1,950	2,185
SGD.....	9-551-850	Station Hosp., CZ, 250-bed.....	None	99,750	150,500	7,080	10,000	850	1,750	3	4	2,176	2,500
SG4/.....	None	Station Hosp., CZ, 300-bed.....	8-565	120,000	160,500	8,500	14,000	925	1,790	3	4	2,746	3,032
SGC.....	9-551-880	Station Hosp., CZ, 500-bed.....	8-566	193,742	393,013	14,042	26,227	1,824	3,196	5½	10	2,563	3,046
SGE**.....	9-551-910	Station Hosp., CZ, 750-bed.....	8-567	260,900	490,000	18,050	26,250	2,050	3,850	7	13	2,567	3,040
SGA**.....	9-253-950	General Hosp., CZ, 1,000-bed.....	8-551	407,171	657,174	30,843	44,481	3,465	5,570	14	20	2,825	3,160
SGV**.....	9-254-000	General Hosp., CZ, 1,500-bed.....	(8-552)	581,311	935,091	45,388	64,277	4,888	8,031	20	26	3,070	3,419
SGW.....	9-254-050	General Hosp., CZ, 3,000-bed*.....	(8-553)	690,000	1,255,050	60,000	84,010	6,100	12,100	18	32	4,000	4,300
SHB**.....	9-144-295	Convalescent Center Army 1,500 Patient.....	8-590	80,000	380,000	5,150	21,000	750	3,100	2	10	977	1,219
SGQ**.....	9-144-295	Convalescent Center Army 1,500 Patients, Army.....	8-590	120,000	640,000	8,700	40,100	1,100	5,500	3	16	1,405	1,900
SGT.....	9-252-700	General Dispensary, Type 1.....	8-500	8,942	13,004	447	665	101	152	LCL	LCL	552	633
SGT**.....	9-252-800	General Dispensary, Type 2.....	8-500	6,450	10,500	350	440	85	130	LCL	LCL	551	635
SAB**.....	9-014-600	Air Group Dispensary, 36-bed.....	1-9022T 1-9012	12,944	20,516	804	1,237	147	220	LCL	LCL	398	493
SGR**.....	9-259-740	Medical General Laboratory, CZ.....	8-650	37,500	50,500	4,100	5,000	200	285	1	2	1,405	1,531
SGS.....	9-259-760	Medical Laboratory, Army.....	8-640	64,369	95,000	6,800	8,050	200	285	2	3	1,422	1,548

*Proposed.

**Estimate.

RESTRICTED

RESTRICTED—Security Information

87. Items of Ordnance Equipment ^{1 2}*a. Amphibious Vehicles*

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—Inches)				
	2	Truck.....	2½-ton, 6x6 Amph DUKW.....	372	99	106	7.4	55.9
3	Landing vehicle tracked.	MK 4, LVT (4), unarmored.....	314	128	121	13.7	71.5
4	Landing vehicle tracked.	MK 4, LVT(A) (4), armored.....	313	128	125	20.0	72.5
5	Landing vehicle..	MK 5, LVT (1) (5), armored.....	313	128	123	19.9	75.4
6	Carrier.....	Cargo M29C, amphibian.....	192	67	71	3.0	13.2

¹ Items exceeding 1 short ton, uncrated.² Weights shown in column 6 for combat vehicles, except half tracks, are fighting (loaded) weights. Those for half tracks and non-combat vehicles are weights of vehicles not loaded.*b. Ground Combat Vehicles.*

1	1	2	3	4	5	6	7
	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—Inches)				
2	Car.....	Armored, light, 6 x 6, M8.....	197	100	88	8.6	25.2
3	Car.....	Armored, light, M38.....	202	95	78	7.6	21.9
4	Car.....	Armored, utility, M20, 6 x 6.....	197	100	91	7.8	25.9
5	Carrier.....	Cargo, M29.....	126	66	71	2.3	8.5
6	Carrier.....	Vehicle, armored, utility, M39.....	214	113	80	16.8	28.2
7	Carrier.....	Infantry vehicle, armored, tracked, M75.	209	108	95	14.3	30.6
8	Carrier.....	Infantry vehicle, armored, tracked, T59	221	129	88	19.4	36.3
9	Carrier.....	Cargo, amphibious, M76 (T46E1)....	193	98	103	4.4	28.4
10	Half track.....	Carriage, motor, multiple, gun (50 cal AAA) M16A1.	257	85	103	9.3	32.0
11	Half track.....	Carrier, 81-mm mortar, half track, M21.	249	88	87	7.8	27.4
12	Half track.....	Carrier, personnel, half track, M3....	249	88	89	7.8	28.1
13	Half track.....	Carrier, personnel, half track, M3A1..	250	88	106	7.7	33.5
14	Carriage motor....	Twin, 40-mm gun, M19A1 (Gun M2 on twin mount, M4).	205	112	119	18.5	39.5
15	Carriage motor....	76-mm gun, M18 (T70) M1A2 Gun....	262	113	101	19.5	34.0
16	Carriage motor....	90-mm gun, M36 (T71) M3 Gun.....	235	120	126	30.5	35.6
17	Carriage motor....	105-mm howitzer, M37 M4 Howitzer..	218	119	104	20.0	39.0
18	Carriage motor....	105-mm howitzer, M7B1, M2A1 Howitzer.	244	116	113	28.2	45.8
19	Carriage motor....	105-mm howitzer, SP T98E1 T96E1 Howitzer.	215	128	134	25.0	53.6
20	Carriage motor....	8-inch howitzer, M43 M1 Howitzer....	289	124	130	41.5	67.2
21	Carriage motor....	8-inch howitzer, SPT 108 T89 howitzer.	325	140	140	45.0	92.7
22	Carriage motor....	155-mm gun, M40 M2 Gun.....	289	124	130	41.5	67.2
23	Carriage motor....	155-mm gun T T80 Gun.....	402	140	140	46.0	114.6
24	Carriage motor....	155-mm howitzer, SP, T194 T186E1 howitzer.	240	128	122	31.0	54.6

RESTRICTED—Security Information*b. Ground Combat Vehicles—Continued*

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—Inches)				
25	Carriage motor....	155-mm howitzer, M41 M1 Howitzer	246	112	98	21.5	38.2
26	Tractor.....	Truck, Gun lifting, heavy, 4 x 4 Front M249 (Transports 280-mm gun).	368	124	120	15.0	79.1
27	Tractor.....	Truck, Gun lifting, Heavy 4 x 4; Rear M250 (Transports 280-mm Gun).	369	124	120	14.5	79.3
28	Tank	Light M24 (T24) (75-mm gun M6)...	198	116	109	20.3	36.1
29	Tank.....	Medium (heavy) M46, (90-mm gun M3A1).	276	138	125	46.0	69.0
30	Tank.....	Medium (heavy) M47, (90-mm gun M36).	276	138	117	46.5	69.0
31	Tank.....	Medium (heavy) T48 (90-mm gun M41).	289	146	115	41.7	68.4
32	Tank.....	Heavy, T43 (120-mm gun T123).....	397.5	146	127	55.8	104.0
33	Tank.....	Medium, M4A3 (76-mm gun M1A2).	296	105	135	35.6	60.4
34	Tank.....	Medium (heavy) M26 (90-mm gun M3).	268	137	109	43.3	57.9
35	Tank.....	Medium, M45 (105-mm howitzer)....	252	139	110	46.2	55.6
36	Tank.....	Light (M41) (76-mm gun M32).....	264	130	111	25.5	56.9
37	Recovery and evacuation.	Truck, 12-ton, 6 x 4, Prime Mover, M20 (Tows Traller M9).	280	100	101	13.5	35.8
38	Recovery and evacuation.	Traller, 45-ton, 12 wheel M9 Transporter.	360	114	62	10.1	36.3
39	Recovery and evacuation.	Semitraller, 45-ton 8 wheel transporter, M15 and M 15A1.	462	150	105	18.1	86.9
40	Recovery and evacuation.	Truck, tractor, 12-ton, 6 x 6, M26, M26A1 (tows semitraller M15).	307	131	118	24.4	73.9
41	Recovery and evacuation.	Vehicle, tank recovery, M32, M32A1.	278	110	116	33.6	51.4

c. Tractors (less those peculiar to other technical services):

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—Inches)				
2	High speed.....	13-ton M5 and M5A1 (M).....	191	100	104	14.1	28.8
3	High Speed.....	18-ton M4 and M4C (M).....	203	97	99	15.7	28.2
4	High speed.....	38-ton, M6 (Hv).....	258	121	104	38.0	45.5
5	High speed.....	Cargo, M8E2 w/T8E4 Bulldozer.....	301	131	120	20.8	68.4

d. Truck Tractors.

	1	2	3	4	5	6	7
	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—Inches)				
1							
2	1½ Ton.....	Truck, 4 x 2.....	202	86	84	2.9	21.2
3	2¼ Ton.....	Truck, 6 x 6.....	228	93	82	5.7	25.2
4	5 Ton.....	Truck, 6 x 6.....	257	97	102	9.2	36.8

e. Trucks.

	1	2	3	4	5	6	7
	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—Inches)				
1							
2	¼ Ton.....	4 x 4, Utility.....	133	62	55	1.2	6.6
3	¾ Ton.....	4 x 4, Ambulance.....	198	74	92	3.6	19.7
4	¾ Ton.....	4 x 4, Command.....	185	74	90	3.0	17.9
5	¾ Ton.....	4 x 4, Cargo.....	189	74	90	3.0	18.4
6	2½ Ton.....	6 x 6, Cargo LWB.....	261	96	125	6.3	45.3
7	2½ Ton.....	6 x 6, Cargo XLWB.....	323	96	125	6.8	56.0
8	2½ Ton.....	Watertank, 1,000 Gal.....	262	95	92	6.6	33.2
9	2½ Ton.....	Gasoline Tank, 1,200 Gal.....	262	95	92	6.9	33.2
10	2½ Ton.....	6 x 6, Dump.....	236	96	108	7.3	35.5
11	5 Ton.....	6 x 6, Cargo.....	294	97	111	9.9	46.1
12	5 Ton.....	6 x 6, Wrecker.....	348	97	106	16.8	51.7
13	7½ Ton.....	6 x 6, Prime Mover.....	297	103	125	14.6	55.5

f. Miscellaneous Motor Vehicles.

	1	2	3	4	5	6	7
	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—Inches)				
1							
2	.....	Motorcycle, solo, chain-driver.....	88	37	59	0.3	1.9
3	.....	Automobile, Sedan, light, 5 passenger.....	197	74	66	1.7	14.0
4	.....	Automobile, Sedan, Medium, 5 passenger.....	207	76	63	1.8	14.4
5	2½ Ton.....	Truck, Crane, 6 x 6.....	301	96	99	9.9	41.7
6	2½ Ton.....	Truck, Shop Van, 6 x 6.....	150	96	129	7.5	27.0
7	2½ Ton.....	Truck, Medical Van, 6 x 6.....	150	96	129	7.5	27.0

RESTRICTED—Security Information

g. Trailers (less those peculiar to other technical services).

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—Inches)				
	2	¼ Ton.....	Cargo, 2-wheel.....	109	56	42	0.3
3	¾ Ton.....	Cargo, 2-wheel.....	147	74	83	.7	13.2
4	1½ Ton.....	Cargo, 2-wheel.....	166	83	97	1.2	19.3
5	1½ Ton.....	Water tank, 2-wheel, 400 gallon.....	166	93	78	1.2	17.5
6		Ammunition, M10.....	140	86	58	1.0	10.1
7		Director, M22 (AA).....	189	96	100	4.5	26.1
8		Generators, M7 (AA).....	189	96	44	2.1	11.5

h. Semi-trailers (less those peculiar to other technical services).

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—Inches)				
2	6 Ton.....	Cargo, 2-wheel.....	274	93	96	3.6	35.6
3	6 Ton.....	Van type, 2-wheel.....	276	96	134	3.7	51.5
4	12 Ton.....	Cargo, 4-wheel.....	344	97	109	6.9	52.9
5	.....	Gasoline, Tank, 4-wheel, 5,000 gallon..	353	97	109	7.4	54.2

i. Towed Weapons.

1	1	2	3		4	5	6	7
	Class	Type or model	Length	Width	Height	Short tons	Meas. tons	
			(Dimensions—Inches)					
2	Antiaircraft.....	Multiple mount, Tir, M55 (cal. 50)...	112	68	60	1.8	-----	
3	-----	Gun, 40-mm, M1 (carrier M2A1, AA)...	226	72	80	2.9	18.8	
4	-----	Gun, 75-mm, T83E7 (Mount T60)...	305	102	85	9.6	38.3	
5	-----	Gun, 90-mm, AA, M2 (mount M2, AA).	355	103	121	16.1	64.0	
6	-----	Gun, 120-mm, AA, M1A3 (mount M1A1, AA).	369	124	124	30.7	81.6	
7	Ground.....	75-mm, pack, M1A1 (carriage M8)...	144	47	34	0.6	3.9	
8	Howitzer.....	105-mm, M2A1 (carriage M2A2)...	236	82	66	2.5	18.5	
9	-----	155-mm, M1 (carriage M1A2)...	288	96	81	6.0	32.4	
10	-----	8-in. M2 (carriage M1)*.....	480	99	103	15.8	70.8	
11	-----	240-mm, M1 (carriage M1).....						
12	-----	Wagon, cannon Trans, M2A1.....	398	108	84	19.8	52.0	
13	-----	Wagon, carriage Trans, M3A1.....	370	114	120	21.1	69.5	
14	-----	Crane, truck mounted, M2.....	403	109	140	27.0	93.0	
15	-----	Tlr, clam shell, M16.....	171	108	124	4.1	42.8	
16	Gun.....	155-mm, M2, (carriage M1)*.....	412	99	109	15.3	63.7	
17	-----	8-in. M1 (carriage M2).....						
18	-----	Wagon, cannon Trans, M1A1.....	497	116	84	25.5	70.3	
19	-----	Wagon, carriage Trans, M3A1.....	433	119	129	26.3	95.8	
20	-----	Crane, Trk Mtd, M2.....	403	109	140	57.3	93.0	
21	-----	Tlr, clam shell, M16.....	171	108	124	4.1	42.8	
22	-----	Launcher, rocket, multiple, 4.5...-	34	36	72	0.6	1.2	
23	-----	280-mm, T131 (carriage T72) (with gun lifting trucks M249 and M250).	1010	124	146	76.0	264.5	

*With limber.

88. Items of Quartermaster Equipment ^{1 2}

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—Inches)				
2	Trailers.....	Bath Unit, Field, Mobile.....	151	72	68	2.1	10.6
3		Laundry, Mobile, Two-Trailer Type:					
4		Washer Trailer.....	168	78	84	2.5	15.9
5		Tumbler Trailer.....	168	78	84	2.5	15.9
6		Bakery Unit, Mobile, M-1945:					
7		Mixing and Make-up Machinery Trailer.	197	88	111	5.5	18.7
8		Oven Trailer.....	200	88	83	3.3	20.8
9		Proofing and Water Trailer.....	207	90	100	3.3	27.0
10		Engine Generator Traller (25 KW, 1-ton, mounted).	244	70	76	1.8	18.8
11		Reclamation and Maintenance, 2-ton:					
12		Clothing Repair Trailer.....	108	67	66	0.9	6.9

¹ Items exceeding 1 short ton, uncrated.

² Weights of vehicles shown in column 6 are weights of vehicles not loaded.

88. Items of Quartermaster Equipment—Continued

1	1	2	3	4	5	6	7
	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—inches)				
13		Textile Repair Trailer.....	108	67	56	0.9	6.9
14		Shoe Repair Trailer.....	108	57	66	0.9	6.9
15	Semitrailleurs.....	6-ton Clothing Repair.....	259	94	132	10	48.3
16		6-ton Laundry.....	259	95	132	10	49.4
17		5-ton Refrigerator.....	242	95	129	11	44.2
18		10-ton Refrigerator.....	257	94	129	3.7	45.1
19		6-ton Shoe Repair.....	270	95	131	10	48.7
20		6-ton Textile Repair.....	270	95	132	10	49.5
21		Petroleum Laboratory, Mobile.....	300	96	118	9.5	49.2

89. Items of Signal Equipment

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—inches)				
2	Radios.....	SCR—399 Including Tlr.....				3.3	30.0
3		SCR—499.....				1.5	5.0
4		AN/GRC—26 Including Tlr.....				3.5	30.0
5	Truck.....	Sig Corps Rep M 30, 2½-ton 6x5.....	256	92	118	8	40.1
6		TP Const & Main V-17/MTQ, 2½-ton 6 x 6.	255	88	108	5.5	32.0
7		Earth Auger V-18/MTQ, 2½-ton 6 x 5.....	255	88	108	5.5	32.0
8		TP Inst & Rep V-41, ¾ ton 4 x 4.....	195	72	75	2.1	15.3
9	Trailer.....	Cable Hauler, K-37, 2W.....	149	84	69	1.5	9.0
10		Cable Splicer, K-38, 2W.....	77	39	42	.2	1.8
11		Pole Hauling, V-13/GT 2W.....	185	88	60	1.2	6.2
12		1 Ton, Cargo, K-52.....	145	72	73	1.5	11.0
13		Central office set magneto and common battery type corps Equip.				1.8	3.6
14		Central office set, common battery type Army Equip.				5.3	13.6
15		Rad relay Equip, FM, about 50 watts, 25-mi range.				2.2	4.7
15		Ground, Trans Rad Equip AM, about 50-watts range, 100-mi (CW).				1.0	2.5
17		Ground, Mbl Rad Equip, AM, about 400-watts. Range 100-300-mi (CW).				5.0	22.4

90. Items of Transportation Equipment ^{1 2}

1	2	3	4	5	6	7
Class	Type or model	Length	Width	Height	Short tons	Meas. tons
		(Dimensions—Inches)				
Barge, nonpropelled.	Deck or liquid cargo, 580 tons or 4160 barrels, 120-foot, design 213-B.	1, 440	396	120	185	990
Barge, self-propelled.	Cargo, steel, 125-foot, design 219-A.	1, 500	385	162	338. 6	1, 350
Tug.	Harbor, diesel, 200-hp, steel, 45-foot design 320.	540	150	96	32	112. 5
Utility boat.	Passenger and cargo, 75-hp, wood, 40-foot, design 186.	400	128	84	8. 4	74. 6
Patrol boat.	Gasoline, 630-hp, wood, 63-foot, design 416.	756	180	105	19. 5	206. 7
Floating crane.	Revolving, diesel-electric, 30-ton, steel, design 317-A.	1, 344	624	114	685. 4	1, 383
Repair Shop.	Floating, nonpropelled, 112-foot, design 440.	1, 344	360	96	242	672
Propulsion Unit.	Marine, outboard, diesel, 300-hp, Design 0-7.	170	69	85	10	13. 2
Locomotive.	82-ton, 2-8-0, Road.	394	117	162	80. 5	108
Steam.	Tender.	288	117	102	15. 5	76. 2
Locomotive, diesel-elec.	127-ton, 0-6-6-0 Road-switch.	656	120	168	123	191. 5
Boxcar.	20-ton.	288	93	137	8. 5	54
	40-ton.	489	104	141	18	103
Gondola.	20-ton, high side.	288	99	97	8. 5	40
	40-ton, high side.	497	111	103	16	82
	40-ton, low side.	489	111	61	15	48
Tanker.	10,000 gallons.	446	92	155	20	92
Refrigerator.	40-ton.	489	104	141	19	103
Flat.	80-ton.	560	123	50	35. 5	50
Helicopter.	H-21, Piasecki.	630	174	192	3. 7	304. 5
Sled.	Micheler, 10-ton.	288	96	36	5	14. 4
Snowmobile.	L'auto Neige Bombardier.	206	76	76	1. 6	17
Truck.	Amphibian, 2½-ton, 6x6, DUKW.	372	98	106	7. 4	55. 9
	Gasoline tank, 2½-ton, 6x6, 750-gal, LWB.	254	91	88	7. 7	29. 4
Semitrailleurs.	10-ton, cargo.	363	96	134	6. 6	68. 5
	Gasoline tank, 2,000 gal.	306	93	96	4. 3	39. 5
	5-ton Refrigerator.	242	96	120	7. 5	44. 2

¹ Items exceeding 1 short ton, uncrated.² Weights of vehicles shown in column 6 are weights of vehicles *not* loaded.

91. Items of Construction and Fortification Materials**a. Engineer*

1	2	3
Type or model	Short tons	Meas. tons
2 Asphalt/mile.....	65.0	54.0
3 Cement.....	1.0	.53
4 Explosive (60% dynamite).....	1.0	1.0
5 Track, 75 lb/yard, rail/mile of track.....	132.0	40.0
6 Track, rail turnout, complete, 75 lb/yard, each.....	9.0	6.3
7 Sand bags, per 100,000.....	16.5	100.0
8 Loose, pit run gravel.....	1.4	1.0
9 Crushed rock, loose.....	1.34	1.0
10 Pipe, 4-in, with fittings (1-mi).....	24.2	-----
11 Pipe, 6-in, L, with fittings and pump (1-mi).....	33.0	-----
12 Pipe, 6-in, Hv, with fittings and pump (1-mi).....	49.5	-----
13 Tank, 10,000-barrel, steel.....	46.0	-----

b. Signal

14	Wire, WD-1()/TT on spool DR-8-()....1,320 ft., 13 lbs.		
15	Wire, WD-1()/TT on wire reel RL-159()/U....5,280 ft., 66 lbs.		
16	Wire, WD-1()/TT on reel DR-5....2½ mi., 145 lbs.		
17	Wire, WD-1()/TT on wire dispenser MX-306()/G (wire, WD-1)/(TT alone weighs 46 lb per mile)....2,640 ft., 26 lbs.		
18	100-mi requirements (spiral four cable) without poles.....	50	74
19	Same with poles.....	211	318
20	300 miles, open wire, crossarms, hardware, etc., without poles.....	527	502
21	Same with poles.....	3,067	3,842
22	100-mi tactical radio (radio relay with carrier Equip).....	42	104

*Items exceeding 1 short ton, uncrated.

Section IV. CLASS III SUPPLY**92. Liquid Fuel and Lubricant Data***a. Vehicles*

1	2	3†	4†	5	6
Vehicle	Vehicle fuel tank capacity (gal.)	Fuel per 100 miles (gal.)	Oil per 100 miles (gal.)	Gear lubricant per 100 miles (lb.)	Miscellaneous greases per 100 miles (lb.)
2 Car, armored, light, M8.....	59	13.3	1.5	0.6	0.9
3 Car, armored, utility, M20.....	56	14.3	1.5	.5	.9
4 Car, armored, M38.....	51	17.0	1.4	.4	.8
5 Car, 5 passenger.....	16	6.4	.2	.1	.1
6 Carriage, motor, 75-mm How, M8.....	89	89.0	3.2	.8	1.5
7 Carriage, motor (76-mm gun) M18.....	165	110.0	4.0	.9	2.4
8 Carriage, motor (twin 40-mm) M19.....	115	100.0	4.0	1.0	2.4
9 Carriage, motor (105-mm How) M37.....	115	100.0	4.0	1.5	2.4

Footnote at end of table.

a. Vehicles—Continued

	1	2	3 ¹	4 ¹	5	6
	Vehicle	Vehicle fuel tank capacity (gal.)	Fuel per 100 miles (gal.)	Oil per 100 miles (gal.)	Gear lubricant per 100 miles (lb.)	Miscellaneous greases per 100 miles (lb.)
10	Carriage, motor (155-mm gun) M40 or (8-in How) M43.	215	200.0	5.0	1.6	2.8
11	Carrier, cargo, M-29.....	25	20.0	1.5	.8	.5
12	Carrier, cargo, M-29C ¹	35	20.0	1.5	1.0	.5
13	Carrier, armored personnel, T18E1.....	150				
14	Carrier, half-track ²	60	30.0	1.1	.7	1.2
15	Compressor, air, Trk-Mtd.....	40	13.3	.3	.5	.3
16	Crane, Trk Mtd ¾ yd capacity.....	50	40.0	.4	.8	.4
17	Grader, Road, Mtd, diesel.....	27	72.0	.8	12.5	2.0
18	Shop Equipment, Mtd, GP.....	45	20.0	.4	.8	.4
19	Motorcycle, solo.....	3.5	2.4	.2	.1	.1
20	Motor, scooter.....	2.0	2.0	.2	.1	.1
21	Tank, light, M24.....	110	115	3.2	1.0	1.5
22	Tank, medium, ³ M4A3 (76-mm).....	175	125.0	4.0	1.5	2.4
23	Tank, medium (heavy) M26, M45.....	183	166.0	4.0	1.6	2.8
24	Tank, light, T41E1.....	140	140			
25	Tank, medium, M46.....	270	300			
26	Tank, medium, M47.....	232	290			
27	Tank, medium, M48.....	215	220			
28	Tractor, medium, high-speed, 13T, M5.....	100	80.0	1.0	1.1	.5
29	Tractor, medium, high-speed, 18T (M4).....	125	70.6	1.4	1.2	.6
30	Tractor, cargo, M8E1.....	225	125			
31	Tractor, heavy, high-speed, 38T (M6).....	300	200.0	2.0	1.8	.5
32	Truck, ¼-ton.....	15	7.0	.2	.2	.2
33	Truck, ¾-ton.....	30	12.5	.3	.3	.3
34	Truck, 1½-ton, 4 x 4.....	30	13.3	.3	.5	.3
35	Truck, 1½-ton, 6 x 6.....	30	12.5	.3	.5	.3
36	Truck, 2½-ton, 6 x 6.....	40	17.9	.4	.8	.4
37	Truck, 4-ton, 6 x 6 ⁴	60	40.0	.6	1.2	.8
38	Truck, 6-ton, 6 x 6, prime mover.....	75	50.0	.9	.7	1.0
39	Truck, 7½-ton, 6 x 6, prime mover.....	160	40.0	.8	.8	1.0
40	Truck, amphibian, 2½-ton ⁵ (DUKW).....	40	16.7	.6	.9	.3
41	Truck, crane, M2.....	100	66.7	.7	.7	.5
42	Truck, wrecking, M1A1.....	100	40.0	.9	.8	1.0
43	Truck-tractor (tank transporter) M26.....	120	62.5	1.5	.9	1.1
44	Truck-tractor, 4-5 ton (7-ton semitrailer).....	60	31.3	.6	1.2	.8
45	Truck-tractor, 5-6 ton (10-ton semitrailer).....	90	18.9	.8	1.0	.9
46	Vehicle, landing, tracked LVT (4), LVT (A) (5). ⁶	162	82.0	2.4	1.3	.8
47	Vehicle, tank recovery, M32A1.....	172	172.0	2.0	1.6	2.8
48	Vehicle, Engr Armd.....	140	166.6	4.0	1.5	2.4

¹ In water, the weasel, M29C, uses 2½ gallons of fuel per hour.² Includes: Carrier, personnel, half-track, M2, M2A1, M9A1; Carriage multiple gun (AA), M15A1, M16; Carrier, 81-mm mortar, M4, M4A1, M21.³ Includes: tank, medium, M4 (76-mm and 105-mm howitzer), M4A1, M4A2, (76-mm and 105-mm howitzer).⁴ Includes wrecker, 4-ton, 6 x 6, w/winch.⁵ In water, use 1.3 miles per gallon.⁶ In water, use 0.6 mile per gallon.⁷ For arctic winter operations, increase amounts by 25%.

RESTRICTED—Security Information

b. Locomotives.

(1) *Fuel oil* (oil burning steam locomotives).

1	2	3		4
	Type of locomotive	Type of operation	Estimated average rate of fuel oil consumption	
			pounds/ train mile	pounds/ hour
2	2-8-0 standard gage.....	Road and switch.....	54	440
3	2-8-2 narrow gage.....	Road and switch.....	- 48	296

(2) *Diesel oil* (diesel-electric locomotives).

1	2	3		4
	Type of locomotive	Type of operation	Estimated average rate of diesel oil consumption	
			gallons/ train mile	gallons/ hour
2	Standard gage:			
	0-6-6-0 DE 120 T 1,600 HP.....	Road.....	1.4	
	0-4-4-0 DE 80 T 750 HP.....	Road and switch.....	.9	6.0
	0-4-4-0 DE 48 T 440 HP.....	Switch.....		3.6
3	Narrow gage:			
	0-6-6-0 DE 80 T 750 HP.....	Road.....	.9	
	0-4-4-0 DE 48 T 440 HP.....	Switch.....		3.6

In estimating fuel requirements, it is recommended 5 percent be added to computed rate of consumption to allow for contingencies.

Estimated lubricating oil and grease requirements for motive power and rolling stock: 1,000 pounds per month for each train per day (moving in either direction) over each division.

(3) *Lubricants.* Estimated lubricating oil and grease requirements for motive power and rolling stock: 1,000 pounds per month for each train per day (moving in either direction) over each division.

c. Marine.

1	2	3	4
	Type	Type or fuel	Estimated average rate or consumption in gallons per hour
	Barge, self-propelled, 125-foot, design 219-A.....	Diesel.....	45.2
	Tug, harbor, 200-hp, steel, 45-foot, design 320.....	Diesel.....	14
	Utility boat, 530-hp, wood, 26-foot, design 207A.....	Diesel.....	4
	Patrol boat, 630-hp, wood, 63-foot, design 416.....	Gasoline.....	72
	Propulsion unit, outboard, 300-hp, design 0-7.....	Diesel.....	35

93. Bulk Petroleum Distribution

1	1	2
	Type carrier	Amount carried
2	Ships (large tankers).....	2.5 to 11 million gallons. ¹
3	Ships (small tankers).....	600,000 to 2,000,000 gallons. ²
4	Barges, harbor and canal types.....	15,000 to 30,000 gallons. ³
5	Barges, coastwise types.....	200,000 to 400,000 gallons. ⁴
6	Barge, Navy pontoon type.....	84,000 gallons. ⁵
7	Railroad tank cars.....	8,000, 10,000, 12,000 gallons.
8	Truck-tractor and trailer F-1.....	4,000 gallons.
9	Truck-tractor and 2 trailers F-1A.....	8,000 gallons.
10	Truck-tractor and trailer F-2.....	2,000 gallons.
11	Truck-tractor and 2 trailers F-2A.....	4,000 gallons.
12	Tank-truck, F-3, fuel or oil.....	750 gallons.
13	Tank-truck, L-2, oil service.....	660 gallons.
14	Trailer, fuel servicing.....	600 gallons.
15	Pipelines	
	4".....	288,000 gallons per day.
	6".....	660,000 gallons per day. ⁶
	8".....	1,670,000 gallons per day.
16	Tanks, bolted steel.....	10,500, 42,000, 420,000 gallons.
17	Tank, portable fabric.....	10,000 gallons. ⁷

¹ The ship tanker most commonly used is the T2-SE-A1, a 5,922,000 gallon tanker. It is 425 feet long and draws 31 feet. It has three 8-inch flanged discharge outlets and four discharge pumps rated 1,000 gpm at 100 psi.

² Draft loaded, 12 to 20 feet.

³ Rectangular hulls.

⁴ Molded hulls.

⁵ 6 x 18 pontoon barge carrying three 42,000 gallon tanks loaded to two-thirds capacity.

⁶ Based on 24,000 gal/hr for 20 hours of operation. In an emergency it can deliver 30,000 gal/hr for 24 hours of operation, or 720,000 gal/day.

⁷ 40 ft. long, 12 ft. wide, 3 ft. high when filled. Empty, it is rolled to 20 in. diam. by 12 ft. long. Ten can be carried in a 6 x 6 truck.

94. Weights, Volumes, and Conversion Factors for Petroleum Products

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Product	Packaging	Weight (pounds)	Cubic feet		Conversion factors		Gallons per short ton	Gallons per long ton	Gallons ¹ per measurement ton	Barrels ¹ per long ton	Packages per short ton	Packages per long ton	Packages per measurement	Capacity of vehicles for carrying filled container ¹		
			Actual	Planning factor	Gallons to pounds	Pounds to gallons								1-ton tr	1½-ton trk	2½-ton trk
2 Aviation gasoline....	Bulk				5.91	0.168	338	376		8.93						
	55-gal drums ¹	359	11.2	12	7.14	.145	290		177		5.57	6.24	3.33	6	9	14
	5-gal drums	41.1	.95	1	8.06	.124	248		200		48.7	54.5	40.0	50	75	120
3 80-octane gasoline....	Bulk				6.14	.163	326	365		8.69						
	55-gal drums ¹	378	11.2	12	7.33	.136	273		177		5.29	5.93	3.33	6	8	14
	5-gal drums ¹	41.9	.95	1	8.30	.121	241		200		47.7	53.5	40.0	50	75	120
4 Kerosene	Bulk				6.80	.147	294	330		7.86						
	55-gal drums ¹	407	11.2	12	7.94	.126	252		177		4.91	5.50	3.33	5	7	12
	5-gal drums	45.2	.95	1	8.85	.113	226		200		44.2	49.6	40.0	45	70	110
5 Diesel fuel	Bulk				6.99	.143	286	320		7.62						
	55-gal drums ¹	423	11.2	12	8.23	.122	243		177		4.73	5.30	3.33			
	5-gal drums	46.2	.95	1	9.26	.108	216		200		43.3	48.5	40.0	45	70	110
6 Lubricating oils....	Bulk				7.60	.132	263	295		7.02						
	55-gal drums ¹	455	11.2	12	8.70	.115	230		177		4.40	4.92	3.33	4	7	11
	5-gal drums ¹	49.2	.95	1	9.76	.103	205		200		40.7	45.5	40.0	40	60	100
	1 qt cans (12 per case)	34.5	.88	1							58.0	64.9	40.0	60	90	145
	1 qt cans (24 per case)	60	1.6	2							33.4	37.3	20.0	35	60	90
	5 qt cans (6 per case)	77	1.9	2							26.0	29.1	20.0	25	40	65
7 Greases	25-lb pails	29	.95	1							69.0	77.2	40.0	70	105	170
	5-lb cans (6 per case)	44	1.1	2							45.4	50.9	20.0	45	70	115

¹ For ocean shipping, storage, and pipeline computations, bulk petroleum products usually are measured in barrels of 42 gallons each, or in long tons.

² Based upon authorized loads in short tons. When overloads are authorized, these quantities may be increased to the cubic capacity of the vehicles or to 100 percent overweight, whichever limit is reached first.

Drums, 55-gallon, normally are filled to 53 gallons to allow for expansion. Drums, 18-gage weight, approximately 51 pounds empty.

⁴ For planning purposes, weight of gasoline may be taken as 42 pounds and weight of lubricating oil for motors as 50 pounds per 5-gallon drum, including weight of the drum. Drums, 5-gallon, weigh approximately 11 pounds empty.

95. Estimating Class III Requirements

a. *Estimating Solid Fuel Requirements.* The factors given below are based on the use of coal only, assuming use of no petroleum products or gas. When firewood or peat is substituted, 2 pounds of such fuel is required in lieu of 1 pound of coal. Factors applicable to temperate climate:

(1) *Utilities.*

Space, water heating and cooking, per man per day.....	4 lb
Cooking only, per man per day.....	1.5 lb
Hospital use, per bed per day, winter.....	12 lb
summer.....	5 lb
Forge, per day per unit.....	6 lb
Railroad engine, per mile of travel on flat to hilly terrain.....	100 lb
Coffee roaster, per day per unit.....	400 lb
Laundry, fixed, per day per unit.....	32 short tons

(2) *Steam locomotives (coal burning).*

	1	2	3	4
	Type of locomotive	Type of operation	Estimated average rate of coal consumption	
			pounds/ train mile	pounds/ hour
2	2-8-0 standard gage.....	Road and switch.....	80	660
3	2-8-2 narrow gage.....	Road and switch.....	72	445

In estimating coal requirements, it is recommended 10 percent be added to computed rate of consumption to allow for contingencies.

For general planning purposes, assume operation of switch engines for 20 hours/day, allowing 4 hours/day for maintenance.

b. *Estimating Gasoline Requirements.* The major factors controlling gasoline requirements in military operations are—

- (1) *Displacement.* By measuring the distance that the center of mass is moved, the average mileage moved by each vehicle is determined. Administrative or march movements are computed on the basis of using available road nets. Movements under battle conditions are computed on the basis of selected elements of the organization proceeding cross country. Experience tables provide consumption data on a mileage basis for moving an organization. For planning purposes, it is assumed that cross country battle consumption is at a rate of 2.5 times that given for road movements in the gasoline and oil supply data tables (pars. 96-102).

RESTRICTED—Security Information

- (2) *Supply.* Certain vehicles of the organization must make round-trip supply movements. Since these movements generally are made to supply points positioned at varying distances from the location of the organization, an average round-trip supply distance must be determined. For purposes of determining distances to supply points, the mid-point of the daily displacement is assumed to be the location of the organization with respect to those supply points. Experience has shown that daily requirements for supply operations are approximately equal to 20 percent of the total organizational consumption per mile of displacement multiplied by the average round-trip supply distance. When the organization is not on the move, supply operation requirements are included in the composite requirement described in (4) below and are not computed separately.
- (3) *Service.* Supplemental daily requirements exist for such purposes as movement of vehicles within bivouac areas and on reconnaissance, warming up engines, and abnormal periods of low-gear operation. These items will differ with the character of the operation, weather, roads and terrain, and must be estimated in accordance with general conditions. Under average conditions, these requirements can be estimated by using the consumption necessary to move all vehicles in the organization ten miles over roads. This factor applies when the organization is on the march or in combat.
- (4) *Housekeeping.* Additional daily requirements exist for administrative vehicles, kitchens, gasoline-powered equipment and maintenance and testing of engines. When the organization is not on the march, these requirements are grouped in a composite daily requirement as noted under each gasoline and oil supply data table. When the organization is on the move, the requirements for administrative vehicles and gasoline-powered equipment are absorbed by displacement requirements; the maintenance and testing factor is absorbed by the service factor; but the kitchen requirement must be added on the basis of a daily consumption per kitchen of 15 gallons of gasoline.
- (5) *Wastage.* This factor covers evaporation, spillage, and small combat losses. It is applied only to road movement in the combat zone. It is computed as 10 percent of the sum of all other consumption figures.

Caution: Refer to notes at foot of gasoline and oil supply data tables (pars. 96–102) for supplemental information and

data necessary to determine complete solutions of estimated requirements.

Example. An armored division (see par. 97) is to make the following movement: 1st day—90 miles in communications zone to bivouac area at rear army boundary; 2d day—no movement; 3d day—60 miles forward in combat zone; and 4th day—10 miles, with 8 miles under cross country battle conditions for all elements except the division trains. Average round trip supply distances are: 1st day—30 miles; 2d day—20 miles; 3d day—40 miles; and 4th day—30 miles. Estimate gasoline requirements for the 4-day period.

1st day

- (a) Multiply 90 (displacement) by 2,740 (gallons per mile)----- =246, 600
- (b) Multiply 30 (supply distance) by 548 (20% of division consumption per mile)----- = 16, 440
- (c) Multiply 10 by 2,740 to account for service requirements----- = 27, 400
- (d) Multiply 15 (gallons) by 97 (organic kitchens)-- = 1, 455

2d day

- (e) From footnote 1, paragraph 97----- = 4, 000

3d day

- (f) Multiply 60 (displacement) by 2,740 (gallons per mile)----- =164, 400
- (g) Multiply 40 (supply distance) by 548 (20% of division consumption per mile)----- = 21, 920
- (h) Multiply 10 by 2,740 to account for service requirements----- = 27, 400
- (i) Multiply 15 (gallons) by 97 (organic kitchens)-- = 1, 455
- (j) Take 10% of (f)+(g)+(h)+(i) to account for wastage----- = 21, 518

RESTRICTED—Security Information*4th day*

- (k) Multiply 2 (road displacement) by 2,740
(gallons per mile)..... = 5,480
- (l) Multiply 8 (road displacement) by 85 (gallons
per mile for division trains)..... = 680
- (m) Multiply 8 (cross-country battle displacement)
by 2,655 (gallons per mile for combat units)
by 2.5 (cross-country battle factor)..... = 53,100
- (n) Multiply 30 (supply distance) by 548 (20%
of division consumption per mile)..... = 16,440
- (o) Multiply 10 by 2,740 to account for service
requirements..... = 27,400
- (p) Multiply 15 (gallons) by 97 (organic kitchens).. = 1,455
- (q) Take 10% of (k)+(l)+(n)+(o)+(p) to account
for wastage..... = 5,146
-
- (r) Total estimate for 4 days—add (a) through (q).. = 642,289
or 642,300 gallons

96. Gasoline and Oil Supply Data—Airborne Division

1	2	3	4	5	6	7	8	9	10	11	12
Unit	Fuel and lubricant requirement motor vehicles consumption in moving unit 100 miles				Gasoline capacity (gallons)			Fuel drum data number of organic 5-gal. fuel drums			Organic kitchens
	Vehicle fuel (gal.)	Engine oil (gal.)	Gear lubrication (lbs.)	Grease miscellaneous (lbs.)	Vehicle tanks	Drums 5-gal.	Total	Resupply, kitchen, airplane, and miscellaneous	Motor vehicle	Total	
2 Div Hq.....	3,620	82	134	82	8,020	9,340	17,400	1,423	440	1,867	7
3 Hq Co, Abn Div.....	551	15	19	15	1,250	1,000	2,250	135	65	200	1
4 Band.....						10	10			2	0
5 Sig Co.....	873	15	23	15	1,940	670	2,610	24	110	134	1
0 MP Co.....	265	7	8	7	585	190	775	1	37	38	1
7 Ord Maint Co.....	689	16	27	16	1,480	440	1,920	0	82	88	1
8 QM Co.....	841	19	36	19	1,880	6,740	8,620	1,240	97	1,348	1
9 QM Preht Maint Co.....	185	5	7	5	405	150	555	7	23	30	1
10 AT Plat.....	166	4	7	4	370	100	470		20	20	0
11 Repl Co.....	50	1	2	1	110	35	145	1	6	7	1
12 3 Inf Regt (ca).....	2,820	70	89	70	5,900	1,840	7,740	28	823	851	19
13 Hq and Hq Co.....	325	9	10	9	715	220	935	9	35	44	1
14 3 Inf Bn (ca).....	403	10	10	10	770	265	1,040	5	209	214	5
15 Hq & Hq Co.....	106	3	3	3	235	80	315	1	15	10	1
16 3 Rifle Co (ca).....	50	1	1	1	70	25	95	1	4	5	1
17 Hv Wpn Co.....	147	4	4	4	325	110	435	1	21	22	1
18 Svc Co.....	683	16	29	16	1,530	400	1,930	1	79	80	1
19 Spt Co.....	367	9	12	9	830	255	1,085	1	50	51	1
20 Mod Co.....	233	6	8	6	520	170	690	2	32	34	1
21 Rcn Co.....	683	29	15	17	1,300	170	1,470	1	33	34	1
22 Engr Bn.....	1,630	38	58	38	3,240	1,230	4,470	38	207	245	4
23 Hq & Hq and Svc Co.....	578	14	22	14	1,300	490	1,790	23	75	98	1
24 3 Engr Co (ca).....	352	8	12	8	645	245	890	6	44	49	1

RESTRICTED—Security Information

96. Gasoline and Oil Supply Data—Airborne Division—Continued

RESTRICTED

RESTRICTED—Security Information

1	2	3	4	5	6	7	8	9	10	11	12
Unit	Fuel and lubricant requirement motor vehicles consumption in moving unit 100 miles				Gasoline capacity (gallons)			Fuel drum data number of organic 5-gal. fuel drums			Organic kitchens
	Vehicle fuel (gal.)	Engine oil (gal.)	Gear lubrication (lbs.)	Grease miscellaneous (lbs.)	Vehicle tanks	Drums 5-gal.	Total	Resupply, kitchen, airplane, and miscellaneous	Motor vehicle	Total	
25 Mod Bn.....	1,060	25	36	25	2,395	780	3,180	10	146	156	3
26 Hq & Hq Co.....	224	5	8	5	455	170	625	2	32	34	1
27 Amb Co.....	528	13	15	13	1,260	395	1,655	1	78	79	1
28 Ctr Co.....	303	7	13	7	680	215	895	7	36	43	1
29 Tk Bn (M) (ea).....	14,600	345	173	250	17,400	11,100	28,500	2,089	122	2,211	4
30 Hq, Hq & Svc Co.....	2,250	60	50	46	3,820	10,900	14,700	2,086	92	2,178	1
31 3 Tk Co (M) (ea).....	4,120	95	41	68	4,540	55	4,600	1	10	11	1
32 Div Arty.....	8,774	188	266	186	17,680	5,210	22,850	157	884	1,041	25
33 Hq & Hq Btry.....	714	10	12	10	1,130	415	1,500	21	62	83	1
34 3 FA Bn, 105-mm How (ea).....	1,261	33	46	33	2,990	975	3,970	25	170	195	5
35 Hq & Hq Btry.....	282	8	10	8	780	335	1,070	21	46	67	1
36 Svc Btry.....	289	7	12	7	650	175	825	1	34	35	1
37 3 FA Btry (ea).....	230	6	8	6	520	155	675	1	30	31	1
38 FA Bn, 155-mm How.....	3,340	56	78	54	5,480	1,270	6,750	57	197	254	5
39 Hq & Hq Btry.....	396	9	12	9	915	400	1,270	21	59	80	1
40 Svc Btry.....	472	11	18	9	980	255	1,240	3	48	51	1
41 3 FA Btry (ea).....	825	12	16	12	1,210	205	1,420	11	30	41	1
42 AAA Bn.....	937	23	38	23	2,100	600	2,690	4	115	119	4
43 Hq & Hq Btry.....	220	5	8	5	490	145	635	1	28	29	1
44 3 AAA AW Btry (ea).....	239	6	10	6	535	150	685	1	29	30	1
45 TOTAL.....	53,427	1,262	1,122	1,058	85,135	44,450	129,590	5,891	4,423	10,314	105

Note.—For Arctic winter operations, increase columns 2 and 3 by 2.

97. Gasoline and Oil Supply Data—Armored Division 1234567

1	2	3	4	5	6	7	8	9	10	11	12
Unit	Fuel and lubricant requirement, motor vehicles consumption in moving unit 100 miles				Gasoline capacity (gallons)			Fuel drum data, number of organic 5-gal. fuel drums			Organic kitchens
	Vehicle fuel (gal.)	Engine oil (gal.)	Gear lubricant (lb.)	Miscellaneous greases (lb.)	Vehicle tanks	Drums 5-gal.	Total	Resupply, airplane, kitchen, and miscellaneous	Motor vehicles	Total	
2 Hq Co, Armd Div.....	2,982	111	62	73	2,897	1,446	4,337	241	47	288	2
3 2 Hq & Hq Cos, CC (ea).....	1,716	50	28	33	1,438	445	1,883	64	25	89	1
4 Hq & Hq Co, Res Comd.....	1,710	50	28	33	1,438	445	1,883	64	25	89	1
5 Sig Co.....	2,977	95	54	63	3,900	1,590	5,490	226	92	318	2
6 MP Co.....	344	11	6	7	931	295	1,226	9	50	59	1
7 Recon Bn.....	13,159	444	248	290	11,211	5,895	17,106	1,045	134	1,179	5
8 Hq, Hq & Sv Co.....	1,197	64	36	42	2,267	5,255	7,522	1,017	34	1,051	1
9 4 Recon Cos (ea).....	2,993	95	53	62	2,230	160	2,390	7	25	32	1
10 Armd Engr Bn.....	15,339	522	294	342	17,540	5,255	22,804	842	209	1,051	6
11 Hq, Hq & Sv Co.....	1,582	51	28	33	2,454	3,435	5,889	630	51	687	1
12 Bridge Co.....	2,357	75	42	49	3,755	1,080	4,835	158	58	216	1
13 4 Engr Cos (ea).....	3,100	99	56	65	2,835	185	3,020	12	25	37	1
14 3 M Tk Bns (ea).....	27,991	896	507	588	23,573	11,105	34,678	2,127	94	2,221	5
15 Hq, Hq & Sv Co.....	5,419	173	98	114	5,881	10,965	16,846	2,107	80	2,187	1
16 4 M Tk Cos (ea).....	5,643	181	102	118	4,423	35	4,458	5	2	7	1
17 Hv Tk Bn.....	28,341	907	511	595	23,421	11,146	34,567	2,152	76	2,228	4
18 Hq, Hq & Sv Co.....	4,662	130	73	85	4,137	10,975	15,112	2,128	76	2,195	1
19 3 Hv Tk Cos (ea).....	9,693	259	146	176	6,428	55	6,483	9	2	11	1
20 4 Armd Inf Bns (ea).....	15,484.5	497	280	328	13,737	5,390	19,127	1,001	77	1,078	5
21 Hq, Hq & Sv Co.....	2,680.5	85	48	56	2,977	5,210	8,187	989	53	1,042	1
22 4 Rifle Cos (ea).....	3,201	103	58	68	2,690	45	2,735	3	6	9	1

See footnotes at end of table.

RESTRICTED—Security Information

97. Gasoline and Oil Supply Data—Armored Division 1 2 3 4 5 6 7—Continued

1	2	3	4	5	6	7	8	9	10	11	12
Unit	Fuel and lubricant requirement motor vehicles consumption in moving unit 100 miles				Gasoline capacity (gallons)			Fuel drum data number of organic 5-gal. fuel drums			Organic kitchens
	Vehicle fuel (gal.)	Engine oil (gal.)	Gear lubrication (lbs.)	Grease miscellaneous (lbs.)	Vehicle tanks	Drums 5-gal.	Total	Resupply, kitchen, airplane, and miscellaneous	Motor vehicle	Total	
23 Div Arty.....	50,034	1,703	901	1,048	53,007	21,055	74,062	3,673	538	4,211	26
24 Hq & Hq Btry.....	2,095	67	38	44	2,129	415	2,544	29	54	83	1
25 3 FA Bns, 105-mm How, SP, Armd (ea).....	9,385	334	169	196	9,610	4,575	14,185	808	107	915	5
26 Hq & Hq Btry.....	8,412	77	43	50	2,164	290	2,454	20	38	58	1
27 3 FA Btrys (ea).....	2,061	65	37	43	1,985	90	2,075	5	13	18	1
28 Sv Btry.....	790	26	15	17	1,491	4,015	5,506	773	30	803	1
29 FA Bn, 155-mm How, SP, Armd.....	8,783	284	158	186	10,355	4,540	14,895	819	89	908	5
30 Hq & Hq Btry.....	1,480	48	27	31	1,694	285	1,979	28	29	57	1
31 3 FA Btrys (ea).....	2,171	70	39	46	2,390	80	2,470	6	10	16	1
32 Sv Btry.....	790	26	14	17	1,491	4,015	5,506	773	30	803	1
33 AAA AW Bn, SP.....	11,001	350	198	230	11,693	2,375	14,068	401	74	475	5
34 Hq & Hq Btry.....	1,445	46	26	30	1,813	1,995	3,808	365	34	399	1
35 4 AW Btrys (ea).....	2,389	76	43	50	2,470	95	2,565	9	10	19	1
36 Div Trains.....	8,457.4	267	147	172	18,516	6,875	25,391	7,435	525	7,960	13
37 Hq & Hq Co.....	407.9	13	7	8	886	625	1,511	88	37	125	1
38 Band.....						10	10	2		2	
39 Repl Co.....	46	1	1	1	110	35	145	3	4	7	1
40 QM Bn.....	2,388.5	75	42	49	5,305	1,355	6,660	6,092	144	6,236	3
41 Hq & Hq Det.....	75	2	1	1	195	55	250	2	9	11	1
42 Sup Co.....	1,114	35	20	23	2,470	625	3,095	6,060	65	6,125	1
43 Fld Sv Co.....	1,187.5	38	21	25	2,640	675	3,315	30	70	100	1
44 Ord Maint Bn.....	4,330.5	138	77	90	9,155	3,265	12,420	1,033	240	1,273	4

RESTRICTED—Security Information

RESTRICTED

RESTRICTED

45	Hq & Hq Co.....	1,318.5	42	23	27	2,750	955	3,705	745	66	811	1
46	3 Maint Cos (ea).....	1,004	32	18	21	2,135	770	2,905	96	58	154	1
47	Armd Med Bn.....	1,296.5	40	20	24	3,060	1,585	4,645	217	100	317	4
48	Hq & Hq Co.....	326	10	5	6	780	850	1,630	142	28	170	1
49	3 Med Cos (ea).....	323.5	10	5	6	760	245	1,005	25	24	49	1
50	TOTAL ARMD DIV.....	273,684.4	8,886	4,948	5,765	261,413	109,755	371,168	26,200	2,336	28,536	97

¹ When the division is not on the march, 4,000 gallons of fuel per day are required for administrative vehicles, kitchens, and gasoline powered equipment. This figure includes the warm up factor.

² When figured separately, daily gasoline consumption for each kitchen is 15 gallons.

³ For cross country battle conditions, fuel and lubricant consumption figures are multiplied by 2.5. (The 10% handling factor need not be applied when this factor is used.)

⁴ When tent stove is issued, add 236 drums, 5 gallon, on the basis of 1 drum per tent stove.

⁵ Data contained in the above table is recommended for planning purposes only. The data above are under development and subject to continuing revision.

⁶ Data for Medical Detachments is included in respective Battalion Headquarters, Headquarters and Service Company figures.

⁷ For arctic winter operations, increase columns 2 and 3 by 25%.

RESTRICTED—Security Information

98. Gasoline and Oil Supply Data—Infantry Division 1 2 3 4 5

RESTRICTED—Security Information

1	2	3	4	5	6	7	8	9	10	11	12
Unit	Fuel and lubricant requirement motor vehicles consumption in moving unit 100 miles				Gasoline capacity (gallons)			Fuel drum data—number of organic 5-gal. fuel drums			Organic kitchen
	Vehicle fuel (gal.)	Engine oil (gal.)	Gear lubricant (lb.)	Miscellaneous greases (lb.)	Vehicle tanks	Drums 5-gal.	Total	Resupply, kitchen, airplane, and miscellaneous	Motor vehicles	Total	
Hq & Hq Co, Inf Div.....	563	14.3	18.7	14.3	1,250	885	2,135	101	76	177	3
Band.....						10	10	2		2	
MP Co.....	412	12	13	11	891	295	1,186	3	56	59	1
Ord Maint Bn.....	2,660	50.2	61	55	4,752	2,850	7,602	316	254	570	2
Hq & Hq Det.....	76	1.9	2.7	1.9	170	60	230	2	10	12	
Ord Co, Fwd.....	1,677	27.7	25.5	33.1	2,587	630	3,217	3	123	126	1
Ord Co, Rear.....	910	20.6	32.8	20	1,995	2,160	4,155	311	121	432	1
QM Co.....	1,380	31	59	31	3,050	7,210	10,260	1,184	158	1,442	1
Recon Co.....	2,026	56.8	26.8	38.6	2,360	145	2,505	1	28	29	1
Repl Co.....	30	1.2	2	1.2	110	45	155	3	6	9	1
Sig Co.....	1,142	27.2	42.8	27.2	2,565	1,245	3,810	104	145	249	2
Med Bn.....	1,010	24	34	24	2,320	1,180	3,600	119	137	256	3
Hq & Hq Co.....	252	6	9	6	560	270	830	23	31	54	1
Amb Co.....	457	11	12	11	1,080	360	1,440	2	70	72	1
Clr Co.....	304	7	13	7	680	650	1,330	94	36	130	1
3 Inf Regts (ea).....	10,250	264.5	266.6	232.4	13,123	5,665	18,788	682	451	1,133	20
Hq & Hq Co.....	444	11.7	13.7	11.7	980	420	1,400	22	62	84	1
Hv Mort Co.....	342	8.4	10	8.4	790	255	1,045	1	60	61	1
Tk Co (M).....	6,780	180	151	147	5,596	55	5,651	1	10	11	1
Med Co.....	232	6	7.5	6	520	220	740	12	32	44	1
Svc Co.....	1,110	23.4	40.9	24.3	2,282	3,695	5,977	625	114	739	1
3 Inf Bns (ea).....	447	11.7	14.5	11.7	985	340	1,325	7	61	68	5
Hq & Hq Co.....	163	4	5	4	360	125	485	3	22	25	1
Hv Wpns Co.....	146	4	4	4	325	110	435	1	21	22	1

RESTRICTED

26	3 Rifle Cos (ea).....	46	1	2	1	100	35	135	1	6	7	1
27	Tk Bn (M).....	23,256	638	535	515	20,683	11,230	31,913	2,091	155	2,246	4
28	Hq & Hq Svc Co.....	2,863	98	82	74	3,805	11,015	14,820	2,088	115	2,203	1
29	3 Tk Cos (ea).....	6,780	180	161	147	5,596	55	5,651	1	10	11	1
30	Engr Bn ¹	3,010	68.1	105.2	70.2	6,515	2,345	8,860	112	357	469	5
31	Hq & Hq & Sv Co.....	1,085	26.8	41.9	27.7	2,650	990	3,640	54	144	198	1
32	4 Engr Cos (ea).....	473	10.1	15.5	10.4	945	330	1,275	14	52	66	1
33	Div Arty.....	14,675	390.3	391.4	332.4	27,035	11,925	38,960	1,102	1,283	2,385	29
34	Hq & Hq Btry.....	424	10.4	14	10.4	960	515	1,475	45	58	103	1
35	3 FA Bns, 105-mm How (ea).....	1,805	42.6	66.4	42.8	4,045	1,965	6,010	162	231	393	5
36	Hq & Hq Btry.....	410	10.3	12.7	10.3	930	420	1,350	26	58	84	1
37	3 FA Btrys (ea).....	320	7.6	12	7.6	725	210	935	1	41	42	1
38	Svc Btry.....	433	9.5	17.7	9.7	940	900	1,840	130	50	180	1
39	FA Bn, 155-mm How.....	3,320	56.1	76.8	47	5,480	2,685	8,165	161	376	537	5
40	Hq & Hq Btry.....	338	8.4	10.4	8.4	770	365	1,135	25	48	73	1
41	3 FA Btrys (ea).....	825	12	16	9.4	1,210	450	1,660	2	88	90	1
42	Svc Btry.....	512	10.8	18.4	10.4	1,080	970	2,050	130	64	194	1
43	AAA AW Bn.....	5,305	191	94	141.5	7,980	2,403	10,410	358	128	486	5
44	Hq & Hq Btry.....	648	15.7	21.1	14.3	1,260	2,090	3,350	354	64	418	1
45	4 AW Btrys (ea).....	1,165	43.8	78.2	31.8	1,870	85	1,955	1	16	17	1
46	Total—Inf Div.....	80,914	2,107	2,089	1,354	110,900	56,460	167,360	7,284	4,008	11,292	109

¹ When the division is not on the march, 4,000 gallons of fuel per day are required for administrative vehicles, kitchens, and gasoline-powered equipment. This figure includes wastage and warmup factors.

² When figured separately, daily gasoline consumption per kitchen is 15 gallons.

³ For cross country battle conditions, vehicle fuel and lubricant consumption figures

for tank units from the table are multiplied by 2.5. (The 10 percent wastage factors need not be applied when this factor is used.)

⁴ Includes allowances for tent stoves.

⁵ For arctic winter operations, increase columns 2 and 3 by 25%.

⁶ Does not include Cranes, diesel tractors, grader.

99. Gasoline and Oil Supply Data—Armored Units^{1 2 3 4 5}

1	2	3	4	5	6	7	8	9	10	11	12
Unit	Fuel and lubricant requirements motor vehicles consumption in moving unit 100 miles				Gasoline capacity (gallons)			Fuel drum data—number of organic 5-gal. fuel drums			Organic kitchens
	Vehicle fuel (gal.)	Engine oil (gal.)	Lubricant (lb.)	Miscellaneous greases (lb.)	Vehicle tanks	Drums 5-gal.	Total	Airplane, kitchen, and miscellaneous	Motor vehicles	Total	
Hq & Hq Co, Armd Gp.....	666.5	21	13	14	735	390	1,025	45	13	58	1
Tk Bn (Hv) (Non-div).....	28,511	907	511	595	23,463	11,140	34,603	2,152	76	2,228	-----
Hq, Hq & Svc Co.....	4,142	130	73	85	4,179	10,975	15,154	2,125	70	2,195	-----
3 Tk Cos (Hv) (ea).....	8,093	259	146	170	6,428	55	6,483	9	2	11	-----
Tk Bn (M) (Non-div).....	25,663.5	638	535	515	21,030	11,140	32,170	2,135	93	2,228	4
Hq, Hq & Svc Co.....	4,024.5	98	82	74	4,074	10,975	15,049	2,129	66	2,195	1
3 Tk Cos (M) (ea).....	7,213	180	151	147	5,666	55	574	2	9	11	1
Armd Cav Regt.....	60,682.5	1,930	1,082	1,262	50,945	42,390	91,335	8,111	367	8,478	20
Hq & Hq Co.....	2,589	82	46	54	2,653	1,290	3,943	177	81	258	1
Svc Co.....	2,254.5	72	40	47	4,340	38,505	42,845	7,613	88	7,701	1
3 Recon Bns (ea).....	18,613	592	332	387	14,702	865	15,567	51	122	173	6
Hq & Hq Co.....	1,943.5	62	35	40	1,620	260	1,880	23	29	52	1
3 Recon Cos (ea).....	2,988.5	95	53	62	2,236	160	2,396	7	25	32	1
Tk Co.....	5,643	180	101	118	4,423	35	-----	2	5	7	1
How Co.....	2,061	65	37	43	1,988	90	2,078	5	13	18	1
Amph Tk Bn.....	17,800	887	20	9	10,600	690	11,300	10	128	138	5
Hq & Hq Svc Co.....	1,610	79	12	5	1,300	170	1,540	2	32	34	1
4 Amph Tk Cos (ea).....	4,040	202	2	1	2,310	130	2,440	2	24	26	1
Amph Trac Bn.....	24,000	1,200	14	7	13,840	815	14,700	14	149	163	3
Hq, Hq & Svc Co.....	3,590	178	10	5	2,430	215	2,640	2	41	43	1
2 Amph Trac Cos (ea).....	10,200	511	2	1	5,700	300	6,010	6	54	60	1

¹ Refer to paragraph 99b.² For kitchens, estimated daily requirement, 15 gallons.³ Data contained in above table is recommended for planning purposes only. The data are under development and subject to continuing revision.⁴ Data for Medical Detachments is included in respective Headquarters, Headquarters and Service Company.⁵ For Arctic winter operations, increase columns 2 and 3 by 25%.

RESTRICTED

RESTRICTED—Security Information

100. Gasoline and Oil Supply Data—Artillery Units

a. Field Artillery^{1 2 3 4} (Non-Divisional)

1		2	3	4	5	6	7	8	9	10	11	12
1	Unit	Fuel and lubricant requirements—motor vehicles										Organic kitchens
		Consumption in moving unit 100 miles				Gasoline capacity—Gallons fuel to fill tanks			Fuel can data—Organic fuel drums			
		Vehicle fuel (gal)	Engine oil (gal)	Gear lubrica- tion (lb)	Grease miscella- neous (lb)	Vehicle tanks	Drums 5-gal.	Total	Aircraft kitchens and mis- cellaneous	Motor vehicle	Total	
2	Hq & Hq Btry, Corps Arty.....	588	14.4	19.2	14.4	1,335	655	1,990	50	81	131	1
3	Hq & Hq Btry, FA Gp.....	348	8.6	11.4	8.6	790	375	1,165	27	48	75	1
4	FA Obsn Bn.....	3,840	74.9	100.4	65.4	7,096	1,725	8,820	7	338	345	4
5	FA Bn, Pk, 75-mm How.....	255	6.1	9.7	6.1	570	395	965	47	32	79	4
6	FA Bn, 105-mm How Towed.....	1,715	40.	63.8	40.2	3,850	1,910	5,760	164	218	382	5
7	Armd FA Bn, 105-mm How, SP.....	7,300	210.6	111.6	143.	8,950	4,530	13,480	769	137	906	5
8	FA Bn, 155-mm How, Towed.....	3,360	57.	78.1	47.9	5,565	2,725	8,290	164	381	545	5
9	Armd FA Bn, 155-How, SP.....	8,355	224.1	111.3	141.1	9,715	4,540	14,255	763	145	908	5
10	FA Bn, Hv, Towed 155-mm Gun or 8-in How.....	3,400	65.7	73.	49.9	8,225	4,365	12,590	485	388	873	5
11	FA Bn, Hv, SP 155-mm Gun or How 8-in.....	5,225	112.4	78.6	67.3	8,000	3,645	11,645	487	242	729	5
12	FA Bn, VH, Towed 240-mm How or 8-in Gun.....	4,000	58.3	65.2	40.9	7,395	4,125	11,520	532	293	825	5
13	Rocket FA Bn, Towed 4.5-in.....	1,770	40.6	67.	41.	3,930	1,120	5,050	4	220	224	4
14	FA Btry Slt.....	875	14.5	26.5	18.1	1,440	405	1,845	5	76	81	1
15	FA Bn, 280-mm Gun.....	(¹)	(²)	(³)	(⁴)	(⁵)	(⁶)	(⁷)	(⁸)	(⁹)	(¹⁰)	(¹¹)
16	Arty Rocket Btry.....	(¹)	(²)	(³)	(⁴)	(⁵)	(⁶)	(⁷)	(⁸)	(⁹)	(¹⁰)	(¹¹)

¹ When experience factors are not available, use 400 gallons fuel per day for miscellaneous small fuel-consuming devices.

² Includes medical detachment.

³ Average daily gasoline consumption (net) is 15 gallons per kitchen.

⁴ For arctic winter operations, increase columns 2 and 3 by 25%.

⁵ Data not available.

b. *Antiaircraft Artillery*^{1 2 3 4} (Non-Divisional)

1	1	2	3	4	5	6	7	8	9	10	11	12
	Unit	Fuel and lubricant requirements—motor vehicles										Organic kitchens
		Consumption in moving unit 100 miles				Gasoline capacity—Gallons fuel to fill tanks			Fuel can data—Organic fuel drums			
		Vehicle fuel (gal)	Engine oil (gal)	Gear lubrica- tion (lb)	Grease miscella- neous (lb)	Vehicle tanks	Drums 5-gal.	Total	Aircraft kitchens and mls- cellaneous	Motor vehicle	Total	
2	AAA Opn Det.....	130	3.	5.	3.	290	110	400	6	16	22	1
3	Hq & Hq Btry AAA Gp.....	300	7.1	11.1	7.	671	235	906	10	37	47	1
4	AAA Gun Bn, 90-mm.....	4,365	79.3	105.8	50.4	8,545	1,400	9,945	31	249	280	5
5	AAA AW Bn, Mbl.....	2,395	55.3	95.2	55.4	5,365	1,795	7,160	70	289	359	5
6	AAA Bn, L, 75-mm Gun, Mbl.....	3,485	61.6	73.6	35.4	6,617	1,560	8,177	27	285	312	4
7	AAA Bn, AW, SP.....	5,365	189.8	95.3	142.7	8,087	2,470	10,557	361	133	494	5
8	Hq & Hq Btry, AAA Brlg.....	340	8.1	13.3	8.0	741	275	1,016	14	41	55	1
9	AAA Gun Bn, 120-mm.....	2,070	33.4	47.3	27.	3,775	795	4,570	32	127	159	5
10	AAA Bn, AW, SmbL.....	835	19.8	30.	20.	1,845	855	2,700	66	105	171	5

¹ Fuel for operations of generators, etc., must be computed separately.² Includes medical detachment.³ Average daily gasoline consumption (net) is 15 gallons per kitchen.⁴ For arctic winter operations, increase columns 2 and 3 by 28%.

RESTRICTED

RESTRICTED—Security Information

101. Gasoline and Oil Supply Data—Chemical Units

1	1	2	3	4	5	6	7	8	9	10	11	12
	Unit	Fuel and lubricant requirements— motor vehicles				Gasoline capacity			Fuel drum data			Organic kitchens
		Consumption in moving unit 100 miles *				Gallons fuel to fill tanks			Organic fuel drum			
		Vehicle fuel (gal)	Engine oil (gal)	Gear lubri- cant (lb)	Grease miscal- laneous (lb)	Vehicle tanks	Drums 5-gal (all)	Total	Kitchens and miscal- laneous	Motor vehicle	Total	
2	Cml Depot Co.....	291	5.8	10.8	6.4	560	155	715	5	26	31	1
3	Cml Maint Co.....	182	4.2	4.9	4.2	415	115	530	1	22	23	1
4	Cml Docon Co.....	337	7.6	14.4	7.6	740	220	960	3	41	44	1
5	Cml Smoko Gonor Bn											
6	Hq & Hq Det.....	(57)	(1.1)	(1.8)	(1.4)	(130)	(55)	(185)	(3)	(8)	(11)	-----
7	Cml Smoke Gonor Co.....	(522)	(13)	(19)	(13)	(1,155)	(2,750)	(3,905)	(482)	(67)	(559)	1
8	Hq & Hq Co, Cml Gp (Fld).....	66	1.7	2.1	1.7	145	55	200	4	7	11	-----
9	Hq & Hq Co, Cml Bn (Svo).....	59	1.5	1.9	1.5	130	50	180	4	6	10	-----

* For arctic winter operations, increase columns 2 and 3 by 25%.

RESTRICTED—Security Information

RESTRICTED

102. Gasoline and Oil Supply Data—Selected Services Units ^{1 2}

	1	2	3	4	5	6	7	8	9	10	11	12
1	Unit	Fuel and lubricant requirements—motor vehicles									Organic kitchens	
		Consumption in moving unit 100 miles				Gasoline capacity—Gallons fuel to fill tanks			Fuel can data—Organic fuel drums			
		Vehicle fuel (gal.)	Engine oil (gal.)	Gear lubrica- tion (lb.)	Grease miscella- neous(lb.)	Vehicle tanks	Drums 5-gal.	Total	Aircraft kitchens and mis- cellaneous	Motor vehicle		Total
2	Engr Dp Trk Co.....	2,050	31.9	61.4	41.6	3,180	575	3,755	5	110	115	1
3	Engr Panel Brg Co.....	1,090	23.4	43.4	23.6	2,340	645	2,985	8	121	129	1
4	Engr Ponton Brg Co.....	1,945	37.5	69.6	40	3,755	1,110	4,865	13	209	222	1
5	Engr Fltg Brg Co.....	2,525	54.1	63.6	58	4,840	1,370	6,210	18	256	274	1
6	Med Amb Co (Sep).....	455	11	12.2	11	1,080	370	1,450	4	70	74	1
7	Trans Amph Trk Co.....	915	28.9	43	17.9	2,100	580	2,680	9	107	116	1
8	Trans Trk Co.....	985	21.9	42.5	22.1	2,165	1,135	3,300	16	211	227	1
9	Trans Hv Trk Co.....	1,625	31.8	61.3	41.5	3,165	2,045	5,210	6	403	409	1
10	Hq & Hq Co Trans Trk Bn.....	160	3.7	4.8	3.8	370	140	510	10	18	28	1
11	Hq & Hq Co QM Gp.....	85	2.1	2.9	2.1	85	95	180	8	11	19	1

¹ Average daily gasoline consumption (net) is 15 gallons per kitchen.² For arctic winter operations, increase columns 2 and 3 by 25%.

Section V. CLASS V SUPPLY

103. Definitions and Responsibilities

a. *Basic Load.* A basic load of ammunition is a prescribed allowance of ammunition authorized to be in possession of a unit. It is expressed in terms of rounds for ammunition fired by weapons and in other units of measure for bulk allotment items. It includes ammunition carried by the individual soldier, the ammunition stowed in self-propelled weapons, the ammunition carried in prime movers and in unit trains. It is established by the Department of the Army based on recommendations of theater commanders. In wartime it is normally requisitioned by and issued to all units located in an active theater, and such other units as may be specifically directed by the Department of the Army. In peacetime it is normally requisitioned by and issued to those units specifically designated by the Department of the Army. The basic load of ammunition is not necessarily loaded on transport at all times but may be stowed at gun positions or stored in dumps. The composition of the basic load of ammunition, including fuzes, by type will, in general, be as established by SB 38-26, 24 March 1952. However, this proportion of type may be varied by Army commanders and unit commanders, based on assigned missions, and will be supplied so far as availability will permit. Bulk allotment items included in the basic load are listed in SB 38-26 and "Logistics, Policies and Priorities." The data for basic loads, as shown in the tables, provides the basis for instruction in all Department of the Army schools, to the exclusion of all other similar data. Under no circumstances will the average 50 percent overload of vehicles be used as a vehicle loading guide.

b. *Available Supply Rate.* The available supply rate is the rate of consumption of ammunition that can be sustained with available supplies, announced by each commander and applicable within his command. For ammunition items fired from weapons, this rate is expressed in rounds per weapon per day. For bulk allotment items such as antitank mines, hand grenades, and demolition explosives, the rate is expressed in terms of units of measure (each, pound) by organization, individual, or vehicle per day. It is flexible to conform to changing operational plans and commitments and changing tactical conditions. It is used as a control within a unit on the amount of ammunition that may be expended by that unit. At army group and army level, the term is also used as a forecast of ammunition availability. The available supply rate is computed on, and applied to, tactical weapons only; that is, the weapons in divisions, and the crew-served weapons in nondivisional tactical units. Weapons in combat

service support units and service support units are excluded unless unusual circumstances necessitate their employment in a combat role.

c. Supply to Units Within Combat Zone. The efficient operation of the ammunition supply system in the combat zone depends upon the maintenance of basic loads, by drawing ammunition from the depot or supply point designated to support the unit. Maintenance of the basic load is the responsibility of the unit commander. The supply installations supporting the unit will fill transportation orders received bearing the statement: "Required to Replenish Basic Load (or Required for Immediate Consumption): Expenditures Are Within Authorized Available Supply Rate." When an ammunition supply point is unable to fill transportation orders, the supply point commander reports that fact promptly to the army ammunition supply officer, requests instructions as to where the ammunition can be obtained, and instructs the unit ammunition representative accordingly.

d. Ground Ammunition Day of Supply. The ground ammunition day of supply is the estimated quantity of ammunition required per day to sustain operations in an active theater in wartime. It is expressed in terms of rounds per weapon per day for ammunition items fired by weapons, and in terms of other units of measure for bulk allotment and other ammunition items. It is used by the Department of the Army for over-all supply planning and supply control purposes and by theater commanders in establishing theater stock levels. The basis is applied to weapons authorized to be in the hands of all troops in the theater, beginning with their arrival in the theater. The ground ammunition day of supply, as established, includes the proportion of types of rounds for each weapon and the proportion of types of fuzes for each of the various types of rounds. The ground ammunition day of supply is contained in Supply Bulletin, SB 38-26. It is for use, initially, in a newly established theater and is the basis for initial stockage of the theater, and for use until such time as experience provides a firm basis for correction. It is applicable to a balanced theater Army command of not less than 150,000 men, and will require evaluation and may require adjustment should the Army command be unbalanced or consist of a lesser number. Modifications or variations of the ground ammunition day of supply, to meet current conditions, are published in the current Supply Supplement. It is used for detailed current planning and supply purposes and is established for major overseas commands, specifically Europe, Far East, Alaska, Pacific, and Caribbean. It is applicable to currently assigned troop strength and organization. It is established by the Department of the Army in conjunction with appropriate theater commanders. In the event that an established theater becomes active, the ground ammunition day of supply established, and published in the Supply Supplement for that theater, continues in effect

until such time as experience determines that revision is required. It is the responsibility of theater commanders, for both new and established theaters, to make continuous studies of ammunition expenditures, and recommend to the Department of the Army necessary changes to established ground ammunition days of supply, in order that planning data will be maintained current. Due consideration will be given to the fact that increases in the ground ammunition day of supply will result in increases in production rates, will require additional manpower and raw materials, and may require additional manufacturing facilities. When a recommended increase must be supported from new procurement, normally a time lag of from 9 months to 12 months occurs between the theater recommendations for the increase and the actual receipt in the theater of operations. Decreases in requirements for ammunition will be promptly reported to the Department of the Army in order that production programs may be adjusted as promptly as possible, with the release of manpower, facilities, and raw materials to other channels.

e. Army Commander. The army commander is responsible for—

- (1) Evaluation of the required supply rates submitted by the corps and other tactical organizations assigned or attached to the army and submission of a consolidated required supply rate to the army group commander.
- (2) Determination of available supply rates to corps and other tactical organizations assigned or attached to the army.
- (3) Submission of ammunition status reports.
- (4) Recommendation of basic load to suit his mission.
- (5) Maintenance of adequate tactical reserves in army ammunition installations and distribution of ammunition within the army area.
- (6) Calling forward ammunition from the communications zone to replenish withdrawals from army ammunition installations.
- (7) Enforcement of supply economy.

f. Corps, Division, and Other Tactical Unit Commanders. Corps, division, and other tactical unit commanders are responsible for—

- (1) Evaluation of the required supply rates submitted by subordinate tactical commands and submission of a consolidated required supply rate to the next higher tactical commander.
- (2) Determination of the available supply rates based on availability to subordinate tactical commanders.
- (3) Maintenance of basic loads at prescribed level.
- (4) Enforcement of supply economy.

g. Procedures. See FM 9-6, "Ordnance Ammunition Service in the Field," and FM 100-10, "Field Service Regulations, Administration."

104. Ordnance Ammunition Day of Supply Data—Weapons

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Weapon	Rounds per weapon per day	Proportion of types ¹	Proportion of fuzes	Proportion of extra fuzes	Container ¹ (Overseas pack)		
						Rounds	Gross weight (pounds)	Average packed weight/ratio (pounds)
	<i>Cal. .30</i>							
1	Carbine.....	0.6	98% Ball.....			1,600	59	0.036
			2% Tracer.....			1,600	58	.036
2	Gun, Machine—All Models.....	50	100% API & TR (4-1) MLB.....			1,000	86	.086
3	Rifle, Automatic (BAR).....	20	80% API—Ctn or 5 rd clip.....			480	40	.083
			20% Tracer—Ctn or 5 rd clip.....			480	42	.087
4	Rifle, M1 Type.....	2	90% API—8 rd clip.....			480	46	.095
			10% Tracer—8 rd clip.....			480	44	.091
5	Rifle, M1903 Type.....	2	90% API—5 rd clip.....			480	40	.83
			10% Tracer—5 rd clip.....			480	42	.087
	<i>Cal. .45</i>							
6	Pistol, Automatic.....	.01	100% Ball.....			1,200	69	.057
7	Sub-Machine Gun.....	3	100% Ball.....			1,200	69	.057
	<i>Cal. .50</i>							
8	Gun, Machine—All Models.....	10	100% API & TR (4-1) MLB.....			210	83	.039
	<i>37-mm</i>							
9	Gun, A.A.....	8	90% HE-T SD.....	100% PD.....		20	85	4.23
			10% APC-T.....			25	111	4.4
10	Gun, Tank or Armored Car.....	3	75% HE.....	100% BD.....		20	91	4.5
			25% APC-T.....			20	101	5
	<i>40-mm</i>							
11	Gun, A.A.....	40	90% HE-T.....	100% PD.....		6	52	8.7
			10% AP-T.....			6	52	8.7
	<i>57-mm</i>							
12	Gun, A.T.....	3	40% HE-T.....	100% PD.....		2	52	25.9
			60% APC-T.....	100% BD.....		4	84	20.9

RESTRICTED

RESTRICTED—Security Information

RESTRICTED

235

13	Rifle, Recoilless.....	3	70% HE.....	100% PD.....		4	44	11
			10% HE, AT.....	100% PI.....		4	45	11.3
			10% WP.....	100% PD.....		4	37	9.3
			10% Canister.....			4	37	9.3
14	60-mm Mortar.....	5	85% HE.....	100% PD.....		8	42	5.3
			5% WP.....	100% PD.....		8	53	6.6
			10% Illum.....	100% MT.....		9	57	6.4
15	75-mm Gun, AA, Skysweeper.....	30	70% HE-T (AA Fire) (w/supp chg; w/o fuze).	50% VT; 50% PDSD.	5% VT & 5% PDSD.	2	67	33.5
			20% HE-T (Terrestrial Fire) (w/sup chg; w/o fuze).	50% VT; 50% PD...	5% PD.....	2	67	33.5
			1% WP.....	100% PD.....				
			3% Marker, colored.....	100% MT.....				
16	Gun, Tank.....	2	6% AP-T.....					
			60% HE (SC).....	100% PD.....	3% CP.....	2	60	30
			20% WP.....	100% PD.....		2	63	31.7
			5% HEP-T.....	100% BD.....				
			10% HVAP-T.....			2	40	24.6
			5% AP-T.....			2	62	31
17	Howitzer.....	25	50% HE (w/supp chg).....	100% PD.....	8.5% VT.....	2	53	26.5
			20% HE (w/supp chg).....	100% MTSQ.....		2	59	29.4
			10% HE, AT.....	100% BD.....		2	53	26.4
			15% WP.....	100% PD.....		2	60	30
			5% HEP-T.....	100% BD.....				
18	Rifle, Recoilless.....	2	50% HE.....	67% PD; 33% MTSQ.	10% MTSQ.....	2	81	40.5
			15% HEP-T.....	100% BD.....				
			15% HEAT.....	100% BD.....		2	72	36
			10% WP.....	100% PD.....		2	77	38.3
			10% Canister.....					
19	76-mm Gun, Tank (M1 series); (T91 series).	2	60% HE.....	100% PD.....	3% CP.....	2	64	32
			5% HE, AT.....	100% BD, PI.....				
			10% WP.....	100% PD.....		2	85	42.5
			5% HEP-T.....	100% BD.....				
			10% HVAP-T or HVAPDS.....			2	63	31.5
			5% AP-T.....			2	75	37.6
			5% Canister.....					

See footnotes at end of table.

RESTRICTED—Security Information

104

104. Ordnance Ammunition Day of Supply Data—Weapons—Continued

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Weapon	Rounds per weapon per day	Proportion of types ¹	Proportion of fuzes	Proportion of extra fuzes	Container ¹ (Oversea pack)		
						Rounds	Gross weight (pounds)	Average packed weight/ ratio (pounds)
20	76-mm—Continued Gun, Tank (New Design)-----	2	50% HE..... 5% HE..... 5% HEAT..... 15% WP..... 5% HEP-T..... 5% HVAP-DS..... 10% AP-T..... 5% Canister.....	100% PD..... 100% MTSQ..... 100% BD, PI..... 100% PD..... 100% BD.....	3% CP..... 3% CP.....			
21	81-mm Mortar-----	20	20% HE (w/supp chg; w/fuze)..... 65% HE (w/supp chg; w/fuze)..... 5% WP..... 10% Illum.....	100% VT..... 100% PD..... 100% PD..... 100% MT.....	10% PD.....	2 4 2 3	40 (HV) 50 (LT) 42 55	20 12.5 21 27.5
22	90-mm Gun, AA; Mobile; Fixed; AMTB.	20	72% HE (AA Fire) (w/supp chg; w/o fuze). 27% HE (Terrestrial) (w/supp chg; w/o fuze). 1% Marker (Colored).....	40% VT; 35% MT; 35% PDSD. 30% VT; 30% MT; 40% PD. 100% MTSQ.....	5% VT and 5% PD..... 5% VT.....	2 2	125 125	62.5 62.5
23	Gun, Tank; AT (M3 series)---	3	62% HE (w/supp chg; w/fuze)..... 5% HE, AT..... 5% HEP-T..... 10% HVAP-T..... 9% WP..... 5% AP-T.....	100% PD..... 100% BD PI..... 100% BD..... 100% PD..... 100% PD.....	5% CP and 5% MTSQ.	2 2 2 2 2 2	132 129 116 119 120 131 130	66 64.5 58 59.5 60 65.5 65

RESTRICTED

24	Gun, Tank and AT (New Design).	3	3% Canister.....			2	110	55
			1% Colored Smoke (3 colors).....			2	132	66
			82% HE (w/supp chg; w/fuze).....	100% PD				
			5% HE, AT.....	100% BD PI	5% CP and 5% MTSQ			
			5% HEP-T.....	100% BD				
			10% HVAP-DS or HVAP-T.....					
			9% WP.....	100% PD				
			5% AP-T.....					
			3% Canister.....					
			1% Colored Smoke (3 colors).....					
25	Gun, SP; AT; ABN.....	3	50% HE (w/supp chg; w/fuze).....	90% PD; 10% MTSQ	5% CP	2	129	64.5
			10% HE, AT.....	100% BD		2	116	58
			10% HE-PT.....	100% BD				
			10% HVAP-DS or HVAP-T.....			2	120	60
			5% AP-T.....			2	130	65
			9% WP.....	100% PD		2	131	65.5
			5% Canister.....			2	110	55
			1% Colored Smoke (3 colors).....			2	132	66
26	105-mm Howitzer, SP; Field; Tank.....	35	48% HE (w/supp chg).....	100% PD	1% CP	2	120	60
			40% HE (w/supp chg; w/o fuze).....	50% MTSQ; 50% VT	25% PD, 1% CP	2	116	58
			0.5% HEAT-FS.....	100% BD				
			1.8% HCBE.....	100% MTSQ		2	115	57.5
			0.5% HEP-T.....	100% PD		2	120	60
			1% Illum.....	100% MTSQ		2	120	60
			8% WP.....	100% PD		2	120	60
			0.2% Smoke (3 colors).....	100% MTSQ		2	115	57.5
			58% HE (w/supp chg; w/fuze).....	100% PD				
27	Mortar 4.2" cm	20	32% HE (w/supp chg; w/o fuze).....	100% VT	25% PD			
			10% WP.....	100% PD				
			50% HE.....	67% PD; 33% MTS	10% MTSQ	2	145	72.5
			20% HE, AT.....	100% BD		2	139	69.5
			5% WP.....	100% PD		2	150	75
			5% Canister.....					
			20% HEP-T.....	100% BD		2	126	63
28	Rifle, Recoilless.....	2						

See footnotes at end of table.

RESTRICTED—Security Information

104. Ordnance Ammunition Day of Supply Data—Weapons—Continued

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Weapon	Rounds per weapon per day	Proportion of types ²	Proportion of fuzes	Proportion of extra fuzes	Container ¹ (Overseas pack)		
						Rounds	Gross weight (pounds)	Average packed weight/ratio (pounds)
29	4.2" Mortar	20	52% HE (w/supp chg; w/fuze)	100% PD		2	68	34
			28% HE (w/supp chg; w/o fuze)	100% VT	25% PD	2	64	32
			15% WP	100% PD		2	70	35
			5% FS	100% PD		2	68	34
30	120-mm Gun, AA	5	100% HE (w/supp chg; w/o fuze)	25% MT; 40% VT; 35% PDSD	5% PD	2	125	62.5
31	Gun, Tank	3	100% Cart Case and Charge Prop			2	³ 156	78
			60% HE (100% Charge Prop, T 21)	100% PD	5% CP and 5% MT SQ	1	66.5	66.5
			10% WP (100% Charge Prop, T 21)	100% PD		2	³ 156	78
			5% HE, AT (100% Charge Prop T41)	100% BD, PI		1	66	66
			10% HEP-T (100% Charge Prop T53)	100% BD		2	³ 156	78
			10% HVAP-DS (100% Charge Prop T49)					
			5% AP-T (100% Charge Prop T-38)			2	64.3	32.2
32	155-mm Gun, Field; SP	25	91.5% HE (w/supp chg; w/o fuze)	70% PD; 10% MTSQ; 20% VT	5% CP; 10% PD	1	95.1	95.1
			0.5% HEP-T	100% BD				
			7.5% WP	100% PD		1	98	98
			0.5% Illum	100% MTSQ		1	102	102
			105% Charge Prop			2	³ 128	64
			125% Primers			2,400	117	.049

RESTRICTED

33	Howitzer, Field; SP	30	89.5% HE (w/supp chg; w/o fuze)	70% PD; 10% MTSQ; 20% VT.	5% CP; 10% PD	1	95	95
			2% HCBE	100% MTSQ		1	95	95
			1% HEP-T	100% BD				
			1% Illum	100% MTSQ		1	102	102
			6% WP	100% PD		1	98	98
			0.5% BE (3 colors)	100% MTSQ		1	87	87
			105% Charge Prop (95% white; 5% green bag)	(WB)		1	30	30
			125% Primers	(GB)		2	28	14
						2,400	117	.049
34	8" Gun, Field	8	100% HE	100% PD	10% CP & 5% MTSQ	1	286	286
			105% Charge Prop			1	185	185
			125% Primers			2,400	117	.049
35	Howitzer, Field; SP	25	100% HE (w/supp chg; w/o fuze)	90% PD; 10% MTSQ	10% CP and 15% VT	1	201	201
			105% Charge Prop (80% white & 20% green bag)			2	105	52.5
			125% Primers			2	66	33
						2,400	117	.049
36	240-mm Howitzer, Field; SP	15	100% HE (w/supp chg; w/o fuze)	65% PD; 25% VT; 10% MTSQ	10% CP; 10% PD	1	361	361
			105% Charge, Prop			1	144	144
			125% Primers			2,400	117	.0
37	280-mm Gun	8	33% HE-DS, T121	75% PD 20% VT 5% MTSQ	10% PD			
			65% HE, T122	75% PD 20% VT 5% MTSQ	5% CP 5% PD 5% VT			
			2% Spotting, T123	100% MTSQ	10% CP			
			Charge Prop	105%				
			Primers	125%				
38	2.36" Launcher, Rocket	1	90% HEAT			8	54	6.8
			10% WP			12	68	5.7

See footnotes at end of table.

RESTRICTED—Security Information

104. Ordnance Ammunition Day of Supply Data—Weapons—Continued

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Weapon	Rounds per weapon per day	Proportion of types ²	Proportion of fuzes	Proportion of extra fuzes	Container ¹ (Oversea pack)		
						Rounds	Gross weight (pounds)	Average packed weight/ratio (pounds)
39	5.5" Launcher, Rocket.....	1	90% HEAT..... 10% WP.....	.....	.....	3	53	17.7
40	Launcher, Rocket, Repeating..	1	90% HEAT..... 10% WP.....	.....	.....	3	53	17.7
41	4.5" Launcher, Rocket, Multiple Tube.	5 per tube.	90% HE..... 10% WP.....	55% PD; 45% VT...	.....	1 1	70 70	70 70

¹ Representative packings are shown.² For planning purposes only.

Abbreviations:

AN Army-Navy.
 AP Armor piercing.
 AP-T Armor piercing—tracer.
 APC-T Armor piercing capped—tracer.
 API Armor piercing incendiary.
 AT Antitank.
 BD Base detonating.
 BE Base ejection.
 BI Base initiating.
 CN Chloracetophenone.
 CN-DM Chloracetophenone diiphenylaminechlorarsine.
 CP Concrete piercing.
 HC Hexachlorethane mixture.
 HD Mustard, distilled.
 HE High explosive.

³ Indicates propelling charge only.

Abbreviations—Continued

HE-T High explosive—tracer.
 HEAT High explosive antitank.
 HEAT-T High explosive antitank—tracer.
 HEP-T High explosive plastic—tracer.
 HVAP-DS Hypervelocity armor piercing—discarding sabot.
 HVAP-T Hypervelocity armor piercing—tracer.
 Illum Illuminating.
 PI Point initiating.
 Prop Propellant.
 MR Simulated mustard.
 MT Mechanical time.
 MTSQ Mechanical time superquick.
 TR Tracer.
 VT Proximity.
 WP White phosphorus.

105. Ordnance Ammunition Day of Supply Data

a. Demolitions and Explosives.

(1)	(2)	(3)	(4)	(5)
Demolitions and explosives	Day of supply (rounds or units per division per day)	Container (Oversea pack)		
		Rounds	Gross weight (pounds)	Average packed weight ratio
Adapter, priming, explosive.....	150 ea.....	5,000.....	84.....	0.010
Block, demolition.....	250 lb.....	.....	.....	.....
Chain, M1 (8 2½ lb. block).....	.....	2 (40 lb.).....	62.....	31.....
Individual, M2 (2½ lb. block).....	.....	16 (40 lb.).....	61.....	3.800
Composition "C" (2¼ lb. block).....	.....	16 (36 lb.).....	56.....	3.500
Cable, detonating, mine clearing, AP.....	1 ea.....	1.....	111.....	111.....
Cap, blasting, special, electric.....	100 ea.....	500.....	57.....	.110
Cap, blasting, special, non-electric.....	200 ea.....	5,000.....	57.....	.011
Charge, propelling, rod, earth, blast driven.....	1 ea.....	50.....	82.....	1.600
Charge, springing, rod, earth, blast driven.....	1 ea.....	20.....	50.....	2.500
Charge, shaped, 15-lb., M2.....	30 ea.....	2.....	58.....	29.....
Charge, shaped, 40-lb., M3.....	30 ea.....	1.....	65.....	65.....
Cord, detonating (ft).....	200 ft.....	5,000.....	95.....	.019
Detonator, concussion-type, M1.....	1 ea.....	50.....	71.....	1.4.....
Detonator, delay, 8-second.....	5 ea.....	200.....	56.....	.280
Detonator, delay, 15-second.....	5 ea.....	200.....	56.....	.280
Dynamite or Ordnance Quarrying expl.....	50 lb.....	165 (stick).....	62.....	.375
Firing, device, delay, M1, asst.....	0.1 set.....	500 (50 sets).....	55.....	.110
Firing, device, pressure, M1A1.....	5 ea.....	250.....	80.....	.320
Firing, device, pressure, release, M5.....	5 ea.....	200.....	50.....	.275
Firing, device, pull, M1.....	5 ea.....	150.....	71.....	.473
Firing, device, pull, friction, M2.....	5 ea.....	150.....	21.....	.140
Firing, device, pull, release.....	5 ea.....	150.....	52.....	.346
Firing, device, release, M1.....	5 ea.....	80.....	42.....	.525
Firing, device, single, 10-minute delay, M1.....	2 ea.....	500.....	55.....	.110
Fuze, blasting, time (ft.).....	500 ft.....	3,000.....	40.....	.010
Kit, bangalore, Torpedo, M1A1.....	1.5 ea.....	1 (10 torpedos).....	168.....	168.....
Lighter, fuze, friction type, M1.....	150 ea.....	2,500.....	63.....	.025
Lighter, fuze, weatherproof, M2.....	50 ea.....	150.....	26.....	.173
Mine, antipersonnel, HE, bounding M2A4.....	10 ea.....	10.....	77.....	7.7.....
Mine, antipersonnel, HE, non-bounding.....	20 ea.....	.....	.....	.....
M3.....	.....	6.....	73.....	12.1.....
M14, NM.....	.....	90.....	40.....	.444
Mine, antitank, HE, heavy, M6A2.....	200 ea.....	1.....	32.....	32.....
Mine, antitank, HE, light, M7A2.....	100 ea.....	8.....	58.....	7.2.....
Primer, Percussion cap, M2.....	64 ea.....	5,000.....	24.....	.004
Simulator, gun, flasb, M110.....	20 ea.....	30.....	53.....	1.8.....
Snake, Demolition, M3.....	0.5 ea.....	1.....	12,180.....	12,180.....
TNT, block, ½-lb.....	200 lb.....	100.....	63.....	.630
TNT, block, 1-lb.....	200 lb.....	50.....	64.....	1.3.....

RESTRICTED—Security Information*b. Grenades and Pyrotechnics.*

(1)	(2)	(3)	(4)	(5)
Grenades and pyrotechnics	Day of supply (rounds or units per divi- sion per day)	Container (Oversea pack)		
		Rounds	Gross weight (pounds)	Average packed weight ratio
Adapter, grenade, projection, M1A2.....	100 ea.....	48.....	49	1
Adapter, grenade, projection, chemical.....	75 ea.....	50.....	50	1
Cartridge, grenade, auxiliary, M7.....	25 ea.....	500.....	21	.042
Cartridge, grenade, rifle.....	50 ea.....	.....	.....	.....
M3 (M1 rifle).....	.....	1,200.....	59	.049
M6 (Carbine).....	.....	3,450.....	68	.016
Flare, trip, parachute, M48.....	10 ea.....	10.....	87	8.700
Flare, trip, M49.....	12 ea.....	25.....	59	2.300
Grenade, hand, fragmentation, MK II.....	400 ea.....	25.....	53	2.100
Grenade, hand, offensive, MK II.....	200 ea.....	50.....	54	1.080
Grenade, rifle, AT, HE, T41 ¹	100 ea.....	10.....	69	6.900
Grenade, rifle, illuminating, T45 ¹	100 ea.....	10.....	35	3.500
Grenade, rifle, smoke, WP ¹	10 ea.....	10.....	32	3.200
Grenade, rifle, smoke, M22 ¹	10 ea.....	10.....	36	3.600
Grenade, rifle, smoke, streamer, M23 ¹	10 ea.....	10.....	36	3.600
Signal, AC, AN-M43-45.....	21 ea.....	144.....	76	.520
Signal, ground, cluster and parachute ¹	40 ea.....	30.....	62	2
Signal, ground, smoke, M62-M66 ¹	36 ea.....	30.....	62	2
Signal, ground, high burst, ranging ¹	10 ea.....	36.....	50	1.400

¹ With cartridges.

106. Basic Data—Chemical Ammunition

a. Chemical Hand Grenades.

	1	2	3	4	5
	Items	Day of supply (rounds per organization per day)	Container		Average weight per round, including packing (lb.)
			Rounds	Gross weight (lb.)	
1					
2	Grenade, hand, irritant (CN-DM) M6: Per MP escort guard Co.....	2.0	16	33	2.0
3	Grenade, hand, tear (CN) M7A1: Per MP escort guard Co; MP Co.....	2.0	16	35	2.1
4	Grenade, hand, incendiary, AN-M14: Per Co, Engr Combat Bn; Armed Engr Bn...	1.0	16	47	2.9
5	Per Co, Engr Pon Co; Engr Fltg Br Co.....	.5			
6	Per Co, Engr Abn Bn.....	3.0			
7	Per Inf Regt, except Abn.....	20.0			
8	Per Inf Regt, Abn 1.....	40.0			
9	Grenade, hand, smoke, WP M15: Per combat Veh, H-Trk M2, M3; ¼-ton Trk...	.2	16	46	2.9
10	Per Armd Car; ¼-ton Trk.....	.1			
11	Per Co, Armd Engr Bn, Engr Combat Bn.....	1.0			
12	Per Co, Engr Pon Bn; Engr Pon Co; Engr Pltg Br Co.....	.5			
13	Per Inf Co.....	2.0			
14	Grenade, smoke, white, (HC) AN-M8: Per Inf Co.....	.5	16	41	2.6
15	Per MP Co.....	2.0			
16	Grenade, hand, riot, CN-M25A1.....		50	60	1.2
	Grenade, smoke, colored, M18 (green, red, violet, yellow):				
17	Per combat Veh (including towed guns).....	.2	16	34	2.1
18	Per AAA gun Btry.....	.5			
19	Per Inf. rifle Co.....	.7			
20	Per Recon Co; FA Btry; Hq AAA Bn; FA Slt Btry.....	1.0			
21	Per Inf Bn Hq; FA Hq Btry; AAA AW Btry.....	1.5			

¹ Applies only when engaged in an airborne assault, otherwise same as infantry.

RESTRICTED—Security Information

b. Smoke Pots, Land Mines, and Incendiaries.

1	2	3	4	5
	Type	Day of supply (rounds per organization per day)	Container	
			Rounds	Gross weight (lb.)
2	Pot, smoke, HC, M1 Per Cml Smoke Genr Co....	60	3	48
3	Pot smoke, floating, HC, M4A2 Per Cml Smoke Genr Co.	30	1	48
4	Pot, smoke, 30-pound, HC, M5.....	(1)	1	47
5	Mine, land, cml, 1-gal.....	(1)	10	15
6	Starter, fire, M1 Per company, Mt and Preht.....	6	216	40
7	Incendiary, safe destroying, M1A1.....	(1)	1	55
8	Incendiary, equip destroying, M2A1.....	(1)	2	33

¹ Not published.

² Shipped empty, filled just before using.

107. Combat Vehicle Ammunition Data

Armament				Miscellaneous stowage ¹			8	9	10	11	Ammunition						
1	2	3	4	5	6	7					12	13	14	15	16	17	18
Combat vehicles	Principal weapon	Cal. .30 MG	Cal. .50 MG	Grenades per vehicle	Flares, signal ground per vehicle	Miscellaneous per vehicle	Rounds per vehicle				Ammunition stowage (in rounds per vehicle)				Rounds per vehicle in trains		
							Principal weapon	Cal. .30 MG	Cal. .45 SMG	Cal. .50 MG	Principal weapon	Cal. .30 MG	Cal. .45 SMG	Cal. .50 MG	Principal weapon	Cal. .30 MG	Cal. .50 MG
Car, half-track, M2A1, TM 9-710, TM 1710A.	-----	1	1	10 hand.....	12	14 mines AT.	-----	7,750	540	700	-----	7,750	540	700	-----	0	0
Carriage, Motor, 90-mm Gun, M36B1, TM 9-748.	Gun, 90-mm, M-3.	1	1	12 hand.....		4 pots HC.	57	2,000	-----	1,000	47	2,000	-----	1,000	10	0	0
Carriage, Motor, 90-mm Gun, M36B2.	90-mm Gun, M-3.	-----	1	-----			57	-----	-----	1,000	47	-----	-----	1,000	10	-----	0
Carriage, Motor, 105-mm Howitzer, M7.	105-mm, M2A1	-----	1	8 hand.....			213	-----	180	600	73	-----	180	600	140	-----	0
Carriage, Motor, 105-mm Howitzer, M7B1.	How. 105-mm, M2A1	-----	1	8 hand.....			214	-----	1,620	300	69	-----	1,620	300	145	-----	0
Carriage, Motor, 105-mm Howitzer, M37.	How. 105-mm, M4.	-----	1	8 hand.....			276	-----	750	990	126	-----	750	990	150	-----	0
Carriage, Motor, 105-mm Howitzer, T98.	105-mm How..	-----	1	8 grenades, smoke or frag.			275	-----	-----	1,100	100	-----	-----	1,100	175	-----	0
Carriage, Motor, 155-mm Howitzer, M41.	155-mm How., M1.	-----	-----	12 hand.....			210	-----	420	-----	22	-----	420	-----	188	-----	-----
Carriage, Motor, 155-mm Howitzer, T90.	155-mm How..	-----	1	8 grenades, smoke or frag.			89	-----	-----	1,100	30	-----	-----	1,100	59	-----	0
Carriage, Motor, 155-mm Gun, M40.	155-mm Gun, M2.	-----	-----	10 rifle, 12 hand.			173	-----	-----	-----	HE. 20 Fuze 25 Prop 20 Prim 50	-----	-----	-----	153	-----	-----

See footnotes at end of table.

RESTRICTED

245

RESTRICTED—Security Information

107

107. Combat Vehicle Ammunition Data—Continued

Armament				Miscellaneous stowage ¹			8	9	10	11	Ammunition						
1	2	3	4	5	6	7					12	13	14	15	16	17	18
Combat vehicles	Principal weapon	Cal. .30 MG	Cal. .50 MG	Grenades per vehicle	Flares, signal ground per vehicle	Miscellaneous per vehicle	Rounds per vehicle				Ammunition stowage (in rounds per vehicle)				Rounds per vehicle in trains		
							Principal weapon	Cal. .30 MG	Cal. .45 SMG	Cal. .50 MG	Principal weapon	Cal. .30 MG	Cal. .45 SMG	Cal. .50 MG	Principal weapon	Cal. .30 MG	Cal. .50 MG
Carriage, Motor, 155-mm Gun, T97.	155-mm Gun.		1	8 hand.			170			1,100	20			1,100	150		0
Carriage, Motor, 8-inch Howitzer, M43.	8-inch How., M1 or M2.			10 rifle, 12 hand.			148				HE 12 Prop 12 Fuze 25 Prim 50				136		
Carriage, Motor, Multiple-gun M16.	4-Cal. .50, MG, M2.			10 rifle, 26 hand.					420	7,100			420	5,000			2,100
Carriage, Motor, Twin 40-mm Gun, M19A1.	Twin 40 Gun, M2.			10 rifle, 12 hand.			720		480		352		480		368		
Carriage, Motor, Multiple Gun, T77.			6							1,365				6,700			1,890
Carriage, Half-track, Mortar, 81-mm M21.	81-Mort, M1.		1	12 hand.		12 mines AT.	120		600	715	97		600	400	23		315
Carrier, half-track, M9A1.		3	1	10 hand.		14 mines, AT.		7,750	540	805		7,750	540	700		0	105
Carrier, personnel, half-track, M3.		1		22 hand.		24 mines, AT.		4,500	540			4,000	540			500	
Carrier, personnel, half-track, M3A1.		1	1	22 hand.		24 mines, AT.		7,750	540	805		7,750	540	700		0	105
Tank, Light, M24.	75-mm, M6.	2	1	8 hand.	12		53	4,375	180	530	48	4,125	180	425	5	250	105
Tank, Light, T41.	76-mm, T91E3		2	8 hand.			62			2,910	57			2,805	5		105
Tenk, M, M4A1 (75-mm Gun).	75-mm, M3.	2	1	12 hand.			114	5,750	600	840	90	4,750	600	630	24	1,000	210
Tenk, M, M4A2 (76-mm Gun) (wet).	76-mm, M1A2.	2	1	12 hand.			94	6,250		840	61	6,250		630	23	0	210

Tank, M, M4A3 (76-mm Gun).	75-mm, M3....	2	1	12 hand.....			102	5,750	800	825	97	4,750	600	390	5	1,000	525
Tank, M, M4A3 (76-mm Gun) (wet).	76-mm, M1A2, M1A1C.	2	1	12 hand.....	12		94	6,750	900	840	71	6,250	900	630	21	500	280
Tank, M, M4A3 (105-mm Howitzer).	105-mm How., M4.	2	1	12 hand.....			79	5,000	900	840	60	4,000	900	630	13	1,000	210
Tank, M, M4A3E2 (75-mm Gun) (wet) assault.	75-mm Gun, M3.	2	1	12 hand.....			132	6,500	900	735	104	6,250	900	630	28	250	105
Tank, M, M4A3E8.....	76-mm, M1A2.	2	1	12 hand.....	12		94	6,875	900	735	71	6,875	900	525	23	0	210
Tank, M, M20.....	90-mm, M3....	2	1	12 hand.....			80	6,090	900	735	70	5,500	900	525	10	500	210
Tank, M, M45.....	105-mm, How.	2	1	12 hand.....			87	5,750	900	760	74	5,500	900	550	13	250	210
Tank, M, M40.....	90-mm, M3A1.	2	1	12 hand.....	12		80	6,000	180	735	70	5,500	180	525	10	500	210
Tank, M, M47.....	90-mm, T119.	1	2	8 hand.....			87	4,875		3,545	71	4,125		3,440	10	750	105
Tank, M, M48.....	90-mm, T139.		2	8 hand.....			77			2,605	60			2,500	17		105
Tank, M, T42.....	90-mm, T119.		2	8 hand.....			70			2,546	60			2,330	10		210
Tank, Hv, T43.....	120-mm, T122.		2	12 hand.....			44			3,930	34			3,825	10		105
Vehicle, Landing, Tracked, (Unarmored) LVT (4).		2	2	24 hand.....				2,000		2,500		4,000		5,000		0	0
Vehicle, Landing, LVT, Tracked, (Armored) LVT (A) (5).	75-mm How., M2 or M2A1	3		24 hand.....	6MB		100	2,000			100	6,000			0	0	
Vehicle, Tank, Recovery, M32A1B3.		1		20 hand.....	12	6 pot smoke.		6,250		1,000		6,250		600		0	315
Vehicle, Utility Armored, T18 (T18E2). ¹			1			Rocket 3.5, M20, 10 rods.				1,900				1,900			0
Vehicle, Utility Armored, M39.			1	12 hand.....		4 pot smoke.				900	When P. M. 42 rds., 3 in.			900			0

¹ Included in basic load.

² Now stowage figures not yet completed.

RESTRICTED

108. Estimated Expenditures of Ammunition.

a. Ammunition Per Weapon Per Day, Expressed in Rounds.¹

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
		Type of combat													
		Attack of position					Covering and security force-action	Defense of position		Inactive situation	Meeting engagement	Pursuit	Retirement or delaying action	Assault of hostile shore	Protracted period
		Permanent fortification		Deliberately organized		Hastily organized		First day	Succeeding days						
		First day	Succeeding days	First day	Succeeding days										
1	Pistol, cal .45.....	2	1	2	1	1	1	2	1	0.2	1	0.2	0.3	2	0.3
2	Carbine, cal .30.....	6	3	6	3	5	4	8	6	1.0	4	1.0	3.0	5	2.0
3	Rifle, cal .30.....	20	15	20	15	15	15	25	15	5.0	15	3.0	10.0	15	6.0
4	Rifle, automatic, cal .30.....	70	40	65	35	50	40	80	50	15.0	40	8.0	30.0	50	20.0
5	Gun, machine, cal .30.....	170	100	160	90	120	100	200	120	40.0	100	20.0	70.0	120	50.0
6	Gun, submachine, cal .45.....	35	20	35	20	25	20	40	25	8.0	20	4.0	15.0	25	10.0
7	Gun, machine, cal .50 (HB) ¹	50	30	50	30	35	30	60	35	15.0	30	5.0	20.0	35	20.0
8	Mortar, 60-mm.....	17	10	16	9	12	10	20	12	4.0	10	2.0	7.0	12	5.0
9	Mortar, 81-mm.....	70	40	64	35	50	40	80	50	16.0	40	8.0	30.0	50	20.0
10	Mortar, 4.2-in.....	70	40	64	35	50	40	80	50	16.0	40	8.0	30.0	50	20.0
11	Rifle, 57-mm (recoilless).....	10	6	16	6	7	6	12	7	2.0	6	1.0	5.0	7	3.0
12	Rifle, 75-mm (recoilless).....	7	4	7	4	5	4	8	5	2.0	4	1.0	3.0	5	2.0
13	Howitzer, 75-mm.....	85	50	80	45	60	50	100	60	20.0	50	10.0	35.0	60	25.0
14	Howitzer, 105-mm towed or SP....	150	90	145	80	110	90	180	110	35.0	90	18.0	65.0	110	45.0
15	Howitzer, 105-mm M4 (tank)....	22	12	20	11	15	12	25	15	5.0	12	3.0	8.0	15	6.0
16	Howitzer, 155-mm towed or SP....	120	70	110	65	85	0	140	85	30.0	70	15.0	50.0	85	35.0
17	Gun, 75-mm tank.....	15	8	13	7	10	8	16	10	3.0	8	2.0	5.0	10	4.0
18	Gun, 76-mm.....	15	8	13	7	10	8	16	10	3.0	8	2.0	5.0	10	4.0
19	Gun, 90-mm tank and antitank....	22	12	20	11	15	12	25	15	5.0	12	3.0	8.0	15	6.0
20	Gun, 155-mm towed or SP.....	85	50	80	45	60	0	100	60	20.0	50	0.0	0.0	60	25.0
21	Gun, 8-in.....	27	16	25	15	20	0	32	20	7.0	16	0.0	0.0	20	8.0

RESTRICTED

RESTRICTED—Security Information

22	Howitzer, 8-in.....	85	50	80	45	60	0	100	60	20.0	50	0.0	0.0	60	25.0
23	Howitzer, 240-mm.....	50	30	50	30	35	0	60	35	12.0	30	0.0	0.0	35	15.0
24	Launcher, rocket, 2.36-in.....	7	4	7	4	5	4	8	5	2.0	4	1.0	3.0	5	3.0
25	Launcher, rocket, 3.5-in.....	5	3	5	3	3	2	6	4	1.0	2	1.0	2.0	4	1.5

¹ Figures were derived from a study of World War II experience plus consideration of postwar developments of matériel and reorganization of units. The quantities are representative of actual requirements when applied to units of regimental size or larger.

² Multiple mounts will require specified quantities for each barrel.

b. Ammunition Per Type Unit Per Day, Expressed in Tons.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
		Type of combat													
		Attack of position					Covering and security force- action	Defense of position		Inactive situa- tion	Meeting engage- ment	Pursuit	Retire- ment or delaying action	Assault or hostile shore	Airborne assault
		Permanent forti- fication		Deliberately or- ganized		Hastily organ- ized		First day	Succeed- ing days						
		First day	Succeed- ing days	First day	Succeed- ing days										
1	Divisional slice.....	850	500	800	450	600	400	1,000	600	200	500	100	350	600	
2	Airborne division.....	466	271	437	249	329	197	545	321	116	287	60	192	333	286
3	Armored division.....	512	297	480	271	361	222	597	366	125	292	66	208	366	-----
4	Infantry division.....	544	317	511	289	386	243	638	390	146	313	69	226	390	-----
5	Corps artillery-155-mm howitzer (per bn).	121	71	111	66	86	80	142	86	30	71	15	51	86	-----
6	Corps artillery-155-mm gun (per bn).	69	40	65	36	48	0	81	48	16	40	0	0	48	-----
7	Corps artillery-8-in howitzer (per bn).	116	68	110	62	82	0	137	82	27	68	0	0	82	-----
8	Army artillery-8-in gun (per bn).	34	20	31	18	25	0	39	25	9	20	0	0	25	-----
9	Army artillery-240-mm how- itzer (per bn).	71	42	71	42	49	0	84	49	17	42	0	0	49	-----

109. Field Artillery Ammunition Expenditures

a. Expressed in Rounds Per Weapon Per Hour. (These figures are suitable for computing expenditures for periods of time less than 6 hours.)

1	Kind of fire or phase of action	2	3	4	5
		Average rate per gun per hour			
		105-mm howitzer	155-mm howitzer	155-mm gun— 8-in bow.	240-mm howitzer— 8-in gun
2	Advance guard action, development, and deployment.	25	12	-----	-----
3	Preparation.....	80	25	25	5
	Supporting fires during the attack (including counter- battery):				
4	First 2 hours.....	50	25	25	5
5	After 2 hours.....	30	15	15	5
6	Exploitation, pursuit, delaying action, or delaying enemy development.	25	12	12	5
7	Counterpreparation.....	60	25	25	5
8	Defensive fires against infantry attack (including coun- terbattery).	50	25	25	5
9	Fortified position.....	50	25	25	8

b. Expressed in Tons Per Battalion Per hour. (These figures are suitable for computing expenditures for periods of time less than 6 hours.)

1	Kind of fire or phase of action	2	3	4	5
		Average tonnage per battalion per hour			
		105-mm howitzer	155-mm howitzer	155-mm gun	240-mm howitzer
2	Advance guard, action, development, and deployment.	11.02	12.35	-----	-----
3	Preparation.....	35.28	25.87	20.55	6.98
	Supporting fires during the attack (including counter- battery):				
4	First 2 hours.....	22.05	25.87	20.55	6.98
5	After 2 hours.....	13.22	15.52	12.33	6.98
6	Exploitation, pursuit, delaying action, or delaying enemy development.	11.02	12.42	9.86	6.98
7	Counterpreparation.....	26.46	25.87	20.55	6.98
8	Defensive fires against infantry attack (including counterbattery).	22.05	25.87	20.55	6.98

110. Ammunition Supply Data—Airborne Division

1	2 Weapon (unit)	3 Rounds per weapon	4 Number of weapons	5 Total basic load		6 How carried		
				Rounds	Tons	Indi- vidual	Vehicle	Trains
	DIV HQ & HQ CO, T/O & E 71-1 & 71-2, BAND, T/O & E 20-107N, 22 Dec 47; SIG CO, T/O & E 11-557; MPCO, T/O & E 19-97; REPL CO, T/O & E 20-7, 3 May 48; PRCHT MAINT CO, T/O & E 10-337; AT PLAT, T/O & E 71-19:							
2	Carbine, cal. .30.....	90	772	69,480	1.141	60	30	-----
3	Gun, machine, cal. .30 (L).....	4,000	4	16,000	.615	-----	4,000	-----
4	Gun, machine, cal. .50.....	530	24	12,720	2.338	-----	530	-----
5	Gun, submachine, cal. .45.....	90	131	11,790	.330	30	60	-----
6	Gun, 90-mm.....	105	6	630	20.317	-----	75	30
7	Launcher, rocket, 3.5-inch.....	4	32	128	.600	-----	4	-----
8	Pistol, cal. .45.....	21	63	1,323	.031	21	-----	-----
9	Rifle, automatic, cal. .30.....	500	3	1,500	.056	180	320	-----
10	Rifle, cal. .30, M-1.....	96	353	33,888	1.457	48	48	-----
11	Grenade, hand.....	-----	-----	750	.794	-----	750	-----
12	Grenade, rifle.....	-----	-----	770	1.115	-----	770	-----
13	Total.....	-----	-----	-----	28.794	-----	-----	-----
	ORD MAINT CO, T/O & E 9-87:							
14	Carbine, cal. .30.....	90	195	17,550	.318	90	-----	-----
15	Gun, machine, cal. .50.....	530	7	3,710	.681	-----	530	-----
16	Gun, submachine, cal. .45.....	90	16	1,440	.055	90	-----	-----
17	Launcher, rocket, 3.5-inch.....	4	5	20	.094	-----	4	-----
18	Pistol, automatic, cal. .45.....	21	5	105	-----	21	-----	-----
19	Rifle, cal. .30.....	96	39	3,744	.206	48	48	-----
20	Grenade, hand.....	-----	-----	200	.212	-----	200	-----
21	Grenade, rifle.....	-----	-----	150	.225	-----	150	-----
22	Total.....	-----	-----	-----	1.728	-----	-----	-----
	QM CO, T/O & E 10-17N:							
23	Carbine, cal. .30.....	90	138	12,420	.228	90	-----	-----
24	Gun, machine, cal. .30.....	530	20	10,600	1.948	-----	530	-----
25	Gun, submachine, cal. .45.....	90	4	360	.055	60	30	-----
26	Launcher, rocket, 3.5-inch.....	4	7	28	.131	-----	4	-----
27	Pistol, automatic, cal. .45.....	21	2	42	-----	21	-----	-----
28	Rifle, cal. .30, M1.....	96	116	11,136	.515	48	48	-----
29	Grenade, hand.....	-----	-----	200	.212	-----	200	-----
30	Grenade, rifle.....	-----	-----	320	.480	-----	320	-----
31	Total.....	-----	-----	-----	3.569	-----	-----	-----
	RECON CO, AIRBORNE DIV, T/O & E 17-77:							
32	Carbine, cal. .30.....	90	54	4,860	0.08	45	30	15
33	Gun, machine, cal. .30 hv.....	2,000	3	6,000	.23	-----	1,000	1,000
34	Gun, machine, cal. .30 flex.....	3,000	15	45,000	1.73	-----	1,500	1,500
35	Gun, machine, cal. .50 HB, flex.....	630	3	1,890	.35	-----	525	105
36	Gun, submachine, cal. .45 ⁶	100	26	2,600	.07	-----	60	40
37	Launcher, grenade, cal. .30 M7A1 ⁷	6	18	108	.16	5 cart.	5 gren.	1 cart. 1 gren.
38	Launcher, rocket, 3.5-inch.....	14	9	126	.59	-----	12	2
39	Mortar, 81-mm.....	95	3	285	1.65	-----	60	35

110. Ammunition Supply Data—Airborne Division—Continued

	1	2	3	4		5			
	Weapon (unit)	Rounds per weapon	Number of weapons	Total basic load		How carried			
				Rounds	Tons	Indi- vidual	Vehicle	Trains	
	RECON CO. AIRBORNE DIV, T/O & E 17-77—Continued								
40	Pistol, auto, cal. .45.....	21	18	378	.01	21			
41	Rifle, auto, cal. .40.....	1,000	3	3,000	.11	60	480	460	
42	Rifle, U. S. cal. .30.....	120	73	8,760	.38	48	48	24	
43	Rifle, 75-mm.....	42	6	252	2.75		34	8	
44	Demolition set, Nr 5 ⁶		3	54 lbs.	.03		X		
	(For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105-107 and 110.)								
45	Total.....				8.14				
	ENGR COMBAT BN, ABN DIV, T/O & E 5-225:								
46	Carbine, cal. .30.....	90	90	8,100	0.137	60		30	
47	Gun, machine, cal. .30 (L).....	2,000	18	36,000	1.386		1,000	1,000	
48	Gun, machine, cal. .50.....	530	24	12,720	2.336		530		
49	Gun, submachine, cal. .45.....	90	52	4,680	.128	60		30	
60	Launcher, rocket, 3.5-inch.....	12	31	372	1.741		6	6	
51	Pistol, cal. .45.....	28	707	19,796	.544	21		7	
52	Rifle, cal. .30.....	96	605	58,080	2.490	48		48	
53	Explosives 12,140 lbs plus 15% for containers.....				6.978				
54	Flare, trip.....			415	1.377			415	
55	Grenade, hand.....			1,008	1.216			1,008	
56	Grenade, rifle.....			240	.360			240	
57	Mine, AP.....			98	.476			98	
58	Mine, AT.....			924	7.939		396	528	
59	Total.....				26.345				
	Three (3) ABN INF REGT (EA), T/O & E 7-31:								
60	Carbine, cal. .30.....	90	880	79,200	1.306	60	30		
61	Gun, machine, cal. .30.....	4,500	51	229,500	8.836		3,000	1,500	
62	Gun, machine, cal. .50.....	530	43	22,790	4.188		530		
63	Gun, submachine, cal. .45.....	90	157	14,130	.777	60		30	
64	Gun, 90-mm.....	135	6	810	26.10		75	60	
65	Launcher, rocket, 2.36-inch.....	20	27	540	1.728		12	8	
66	Launcher, rocket, 3.5-inch.....	18	56	1,008	4.728		12	6	
67	Mortar, 60-mm.....	72	27	1,944	5.616		36	36	
68	Mortar, 81-mm.....	120	12	1,440	10.500		48	72	
69	Mortar, 4.2-inch.....	144	8	1,152	19.728		74	70	
70	Pistol, cal. .45.....	30	421	11,788	.324	21		7	
71	Rifle, cal. .30.....	740	135	99,900	3.741	60	380	300	
72	Rifle, M1 and M1C.....	104	1,745	181,480	7.798	48	24	32	
73	Rifle, 57-mm.....	44	27	1,188	4.229		28	16	
74	Rifle, 75-mm.....	42	12	504	5.506		34	8	
75	Flares, trip.....			675	1.763			675	
76	Grenade, hand.....			2,419	2.937			2,419	
77	Grenade, rifle.....			990	1.483			990	
78	Mines, AT.....			1,000	3.250			1,000	
79	Total—One Regt.....				91.048				

For explanation of notes, see paragraph 111.

For total weight of basic load, see paragraph 111d.

RESTRICTED—Security Information**110. Ammunition Supply Data—Airborne Division—Continued**

1	Weapon (unit)	2 Rounds per weapon	3 Number of weapons	4 Total basic load		5 How carried		
				Rounds	Tons	Indi- vidual	Vehicle	Trains
	ABN DIV ARTY, T/O & E 6-200:							
80	Carbine, cal. 30.....	90	2,506	225,540	3.72	60	30	-----
81	Gun, antiaircraft, twin 40-mm (ea).....	264	24	6,336	20.988	-----	144	120
82	Gun, machine, cal. 50.....	530	145	76,850	14.14	-----	530	-----
83	Gun, CA, cal. 50 (multiple mount 4 guns).....	5,300	24	127,200	23.376	-----	3,180	2,120
84	Gun, submachine, cal. 45.....	90	345	31,050	1.3	45	45	-----
85	Howitzer, 105-mm.....	250	36	9,000	220.50	-----	60	190
86	Howitzer, 155-mm.....	150	12	1,800	103.50	-----	50	100
87	Launcher, rocket, 3.5-inch.....	6	209	1,254	5.89	-----	6	-----
88	Mortar, 60-mm.....	36	3	108	.32	-----	36	-----
89	Pistol, cal. 45.....	21	45	945	.05	21	-----	-----
90	Grenado, rifle.....	-----	-----	170	.260	-----	170	-----
91	Total.....	-----	-----	-----	393.774	-----	-----	-----

1	Weapon (unit)	2 Rds/ wpm	3 No. of wpns (T/O & E only) 1 2 13	4 Basic load for T/O & E wpns		5 How carried (rds. per weapon) 1		
				a. Rds	b. Tons	a. Ind.	b. Veh. 4	c. Tns.
	M TK BN, AIRBORNE DIV 17- 35N 23 Apr 48:							
92	Carbine, cal. 30.....	85	292	24,820	0.41	45	15	25
93	Gun, machine, cal. 30, hv.....	2,000	1	2,000	.08	-----	1,000	1,000
94	Gun, machine, cal. 30, flex.....	3,250	11	35,750	1.38	-----	1,000	2,250
95	Gun, machine, cal. 50 HB, flex.....	525	14	7,350	1.36	-----	525	-----
96	Gun, submachine, cal. 45 4.....	100	147	14,700	.40	-----	60	40
97	Launcher, grenade, cal. 30, M7A1 1	10	4	40	.06	5 car- tridges	5 gren- ades	5 ea car- tridges and gren- ades.
98	Launcher, rocket, 3.5-inch.....	9	18	162	.76	-----	6	3
99	Mortar, 81-mm.....	99	1	99	.57	-----	60	39
100	Pistol, auto, cal. 45.....	21	357	7,497	.21	21	-----	-----
101	Rifle, auto, cal. 30.....	1,500	1	1,500	.06	60	480	960
102	Rifle, U. S. cal. 30.....	120	19	2,280	.10	48	48	20
103	Demolition set, Nr 5.....	-----	1	18 lbs	Negl	-----	X	-----
104	Mines, AT, M7.....	-----	-----	200	.65	-----	-----	200
	(For flares, grenades, etc., and all ammunition for all BNL weapons, see paragraphs 105-107 and 110.)	-----	-----	-----	-----	-----	-----	-----
105	Total.....	-----	-----	-----	6.04	-----	-----	-----

For explanation of notes, see paragraph 111.

For total weight of basic load, see paragraph 111d.

111. Ammunition Supply Data—Armored Division—Basic Load

a. Basic load. The data contained in the tables in *b* below indicate that portion of the basic load of ammunition for the weapons authorized the unit by the appropriate T/O & E. Additional ammunition required to complete the unit's basic load is dependent upon the type of combat vehicles and the number of each authorized. This additional ammunition may be readily computed by utilizing the information for combat vehicles contained in paragraph 107.

(1) To compute the basic load of ammunition of a unit—

(a) Determine the type of combat vehicles and the number of each in the unit.

(b) For each type of combat vehicle in the unit, multiply the number of rounds of each type ammunition per vehicle (column 2 or 3, paragraph 107) by the number of vehicles in the unit. This determines the ammunition required for the vehicular weapons.

(c) Next add the amounts of ammunition determined above to the amounts indicated in the appropriate portion of the Table for T/O & E weapons contained in *b* below. The sum of these figures will give the basic load of ammunition for the unit. Weight of the basic load of ammunition can be determined by using column 7, paragraph 104 which gives weight per round.

(2) The basic load of Armor units listed in paragraphs 110, 112, or 113 may be computed in the same manner as outlined in (1) above.

(3) Subparagraphs *c* and *d* below list the weights of the basic load of ammunition for each type armor unit utilizing specific vehicles as indicated and may be used for planning purposes and supply problems.

b. Ammunition Supply Data—Armored Division.¹²

1	2	3	4		5		
			Basic load for T/O & E wpns		How carried (rds per weapon) ¹		
Weapon (unit)	Rds/ wpn	No. of wpns ¹¹ (T/O & E only)	a. Rds.	h. Tons	a. Ind.	b. Veh. ⁴	c. Tns. ⁵
HQ & HQ CO, ARMD DIV, T/O & E 17-2N:							
2 Carbine, cal .30.....	90	141	12,690	.21	45	45	-----
3 Oun, machine, cal .30, flex.....	2,000	3	6,000	.23	-----	2,000	-----
4 Gun, machine, cal .50 HB, flex.....	525	2	1,050	.19	-----	525	-----
5 Gun, submachine, cal .45 ⁶	100	48	4,800	.13	40	60	-----
6 Launcher, grenade, cal .30, M7A1. ⁷	10	9	90	.14	-----	10	-----
7 Launcher, rocket, 3.5-inch.....	5	8	40	.19	-----	5	-----

See footnotes at end of table.

RESTRICTED—Security Information*b. Ammunition Supply Data—Armored Division—Continued*

1	2 Weapon (unit)	3 Rds/ wpm	4 No. of wpns ^{1,2} (T/O & E only)	5 Basic load for T/O & E wpns		6 How carried (rds per weapon) ³		
				a. Rds.	b. Tons	a. Ind.	b. Veh. ⁴	c. Tns.
	HQ & HQ CO, ARMD DIV, T/O & E 17-2N—Continued							
8	Pistol, auto, cal .45.....	21	40	840	.02	21		
9	Rifle, auto, cal .30.....	1,000	3	3,000	.11	200	800	
10	Rifle, U. S. cal .30.....	96	27	2,592	.11	48	48	
11	Rifle, 75-mm..... (For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105- 107 and 110.)	48	3	144	1.57		48	
	Total.....				2.90			
	HQ & HQ CO, COMBAT OR RESERVE COMMAND, T/O & E 17-20-1N:							
12	Carbine, cal .30.....	90	56	5,040	.08	45	45	
13	Gun, machine, cal .30 flex.....	2,000	3	6,000	.23		2,000	
14	Gun, machine, cal .50 HB, flex.....	525	1	525	.10		525	
15	Gun, submachine, cal .45 ⁶	100	34	3,400	.09	40	60	
16	Launcher, rocket, 3.5-inch.....	10	8	80	.38		10	
17	Pistol, auto, cal .45.....	21	19	399	.01	21		
18	Rifle, U. S. cal .30..... (For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105- 107 and 110.)	96	5	480	.02	48	48	
	Total.....				.91			
	ARMD SIG CO, T/O & E 11-57N:							
19	Carbine, cal .30.....	90	288	25,920	.43	45	45	
20	Gun, machine, cal .50 HB, flex.....	525	22	11,550	2.14		525	
21	Gun, submachine, cal .45 ⁶	100	84	8,400	.23	40	60	
22	Launcher, rocket, 3.5-inch.....	10	7	70	.33		10	
23	Pistol, auto, cal .45..... (For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105- 107 and 110.)	21	2	42	Negl	21		
	Total.....				3.13			
	MP CO, ARMD DIV, T/O & E 19-27N:							
24	Carbine, cal .30.....	90	78	7,020	.12	45	45	
25	Gun, machine, cal .50 HB flex.....	525	2	1,050	.19		525	
26	Gun, submachine, cal .45 ⁶	100	50	5,000	.14	40	60	
27	Launcher, grenade, cal .30, M7A1. ⁷	5	36	180	.27		5	
28	Launcher, grenade, M8. ⁷	5	26	130	.20		5	
28	Launcher, rocket, 3.5-inch.....	5	5	25	.12		5	
29	Pistol, auto, cal .45.....	21	96	2,016	.06	21		
30	Rifle, U. S. cal .30..... (For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105- 107 and 110.)	96	36	3,456	.15	48	48	
	Total.....				1.25			

See footnotes at end of table.

b. Ammunition Supply Data—Armored Division—Continued

1	2	3	4		5		
			Basic load for T/O & E wpns		How carried (rds per weapon) ²		
Weapon (unit)	Rds/ wpm	No. of wpns ¹ (T/O & E only)	a. Rds.	b. Tons	a. Ind.	b. Veh. ⁴	c. Tns. ⁵
HQ & HQ CO, ARMD DIV TN, T/O & E 17-60-1N:							
31 Carbine, cal .30.....	90	141	12,690	.21	45	45	-----
32 Gun, machine, cal .30, flex.....	2,000	5	1,000	.39	-----	2,000	-----
33 Gun, machine, cal .50, HB, flex.....	525	2	1,050	.19	-----	525	-----
34 Gun, submachine, cal .45.....	100	38	3,800	.10	40	60	-----
35 Launcher, grenade, cal .30, M7A1. ⁷	10	2	20	.03	-----	10	-----
36 Launcher, rocket, 3.5-inch.....	10	4	40	.19	-----	10	-----
37 Pistol, auto, cal .45.....	21	9	189	.01	21	-----	-----
38 Rifle, U. S. cal .30.....	96	11	1,056	.05	48	48	-----
(For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105- 107 and 110.)							
Total.....	-----	-----	-----	1.17	-----	-----	-----
BAND, ARMD DIV, T/O & E 20-107N:							
39 Carbine, cal .30.....	90	70	6,300	.10	90	-----	-----
Total.....	-----	-----	-----	.10	-----	-----	-----
QM BN, ARMD DIV, T/O & E 10-56N:							
40 Carbine, cal .30.....	90	221	19,890	.33	45	45	-----
41 Gun, machine, cal .50, HB, flex.....	525	32	16,800	3.11	-----	525	-----
42 Gun, submachine, cal .45.....	100	18	1,800	.05	40	60	-----
43 Launcher, rocket, 3.5-inch.....	10	13	130	.61	-----	10	-----
44 Pistol, auto, cal .45.....	21	3	63	Neel	21	-----	-----
45 Rifle, U. S. cal .30.....	96	174	16,704	.72	48	48	-----
Total.....	-----	-----	-----	4.82	-----	-----	-----
ORD MAINT BN, ARMD DIV, T/O & E 9-65N:							
46 Carbine, cal .30.....	90	414	37,260	.61	45	45	-----
47 Gun, machine, cal .50, HB, flex.....	525	56	29,400	5.44	-----	525	-----
48 Gun, submachine, cal .45.....	100	72	7,200	.20	40	60	-----
49 Launcher, rocket, 3.5-inch.....	10	17	170	.80	-----	10	-----
50 Pistol, auto, cal .45.....	21	243	5,103	.14	21	-----	-----
(For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105- 107 and 110.)							
Total.....	-----	-----	-----	7.19	-----	-----	-----
REPL CO, ARMD DIV T/O & E 20-7N:¹⁰							
51 Carbine, cal .30.....	90	41	3,690	.06	45	45	-----
52 Gun, machine, cal .50, HB, flex.....	525	1	525	.10	-----	525	-----
53 Launcher, grenade, cal .30, M7A1. ⁷	5	52	260	.39	-----	-----	11 5
54 Launcher, rocket, 3.5-inch.....	10	4	40	.19	-----	-----	11 10
Total.....	-----	-----	-----	.74	-----	-----	-----

See footnotes at end of table.

RESTRICTED—Security Information*b. Ammunition Supply Data—Armored Division—Continued*

1	Weapon (unit)	2 Rds/ w/pn	3 No. of wpns 1: (T/O & E only)	4 Basic load for T/O & E wpns		5 How carried (rds per weapon) 2		
				a. Rds.	b. Tons	a. Ind.	b. Veh. 4	c. Tns. 5
	ARMD ENGR BN, T/O & E 5-215N; 5-216N w/C2; 5-218N w/C1; 5-217N, w/C2:							
55	Carbine, cal .30.....	90	153	13,770	.23	45	15	30
56	Explosives (in demolition sets).....		13,156 lbs.		7.57		8,520 lbs.	4,636 lbs.
57	Gun, machine, cal .30 flex.....	2,000	28	56,000	2.16		1,000	1,000
58	Gun, machine, cal .50, HB, flex.....	525	32	16,800	3.11		315	210
59	Gun, submachine, cal .45 6.....	100	116	11,600	.32	40	60	
60	Launcher, grenade, cal .30, M7A1.7	5	112	560	.84		5	
61	Launcher, rocket, 3.5-inch.....	10	44	440	2.06		10	
62	Pistol, auto, cal .45.....	21	65	1,365	.04	21		
63	Rifle, U. S. cal .30.....	104	763	79,352	3.41	56	48	
64	Demolition set, Nr 1.....		48					
65	Demolition set, Nr 2 9.....		12	(Weight of explosives included under that beading)				
66	Demolition set, Nr 5.....		36					
67	Mines, AT, M6 (ea).....			1,224	18.36		612	612
68	Mines, AP, (ea) M2A3..... (For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105- 107 and 110.)			98	.37			98
	Total.....				38.47			
	RCN BN, ARMD DIV, T/O & E 17-45N, w/C1, 2; 17-46N, w/C12; 17-57N, w/C1, 2:							
69	Carbine, cal .30.....	90	324	29,160	.48	45	30	15
70	Gun, machine, cal .30 hv.....	2,000	12	24,000	.92		1,000	1,000
71	Gun, machine, cal .30, flex.....	3,000	29	87,000	3.35		1,500	1,500
72	Gun, machine, cal .50, HB, flex.....	630	17	10,710	1.98		525	105
73	Gun, submachine, cal .45 6.....	100	104	10,400	.29	40	60	
74	Launcher, grenade, cal .30, M7A1.	6	48	288	.43	5 cart	5 gren	1 ea cart and gren
75	Launcher, rocket, 3.5-inch.....	14	36	504	2.36		12	2
76	Mortar, 81-mm.....	95	12	1,140	6.61		60	35
77	Pistol, auto, cal .45.....	21	151	3,171	.09	21		
78	Rifle, auto, cal .30.....	1,000	12	12,000	.45	60	480	460
79	Rifle, U. S. cal .30.....	120	275	33,000	1.42	48	48	24
80	Mines, AT, M7..... (For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs, 105- 107 and 110.)			272	.88		96	176
	Total.....				19.26			

See footnotes at end of table.

b. Ammunition Supply Data—Armored Division—Continued

1	2	3	4		5		
			Basic load for T/O & E w pns		How carried (rds per weapon) ^a		
Weapon (unit)	Rds/ w p n	No. of w p n s ¹ (T/O & E only)	a. Rds.	b. Tons	a. Ind.	b. Veh. ⁴	c. Tns. ⁴
ARMD INF-BN, T/O & E 7-25N, w/C1, 2; 7-26N, w/C2; 7-27N w/C1:							
81 Carbine, cal .30.....	90	336	30,240	.50	45	30	15
82 Gun, machine, cal .30, hv.....	2,000	38	76,000	2.93	-----	1,000	1,000
83 Gun, machine, cal .30, flex.....	3,000	45	135,000	5.20	-----	1,500	1,500
84 Gun, machine, cal .50, HB, flex.....	525	9	4,725	.87	-----	315	210
85 Gun, submachine, cal .45 ⁴	160	123	19,680	.54	40	60	60
86 Launcher, grenade, cal .30, M7A1. ⁷	6	146	876	1.31	5 cart	5 gren	5 ea cart & gren
87 Leuncher, grenade, M8. ⁷	10	3	30	.05	5 cart	5 gren	5 ea cart & gren
88 Launcher, rocket, 2.36-inch.....	8	40	320	1.02	-----	8	-----
89 Launcher, rocket, 3.5-inch.....	12	17	204	.96	-----	6	6
90 Mortar, 60-mm.....	200	12	2,400	6.60	-----	160	40
91 Mortar, 81-mm.....	99	1	99	.57	-----	60	39
92 Pistol, auto, cal .45.....	21	88	1,848	.05	21	-----	-----
93 Rifle, auto, cal .30.....	1,000	37	37,000	1.39	60	480	460
94 Rifle, U. S. cal .30.....	120	420	50,400	2.17	48	48	24
95 Rifle, U. S. cal .30 (Sniper's).....	96	36	3,456	.15	48	48	-----
96 Demolition set, Nr 5. ⁴	(1 set per com- pany)	5	-----	0.04	-----	X	-----
(For flares, grenades, etc., and all ammunition for ell SNL weapons, see paragraphs, 105- 107 and 110.)							
Total.....				24.35			
HV TK BN, T/O & E 17-35N w/C1; 17-36N w/C1; 17-37N w/C1, 2:							
97 Carbine, cal .30.....	85	291	24,735	.41	45	15	25
98 Gun, machine, cal .30, hv.....	2,000	1	2,000	.08	-----	1,000	1,000
99 Gun, machine, cal .30, flex.....	3,250	11	35,750	1.38	-----	1,000	2,250
100 Gun, machine, cal .50, HB, flex.....	525	13	6,825	1.26	-----	525	-----
101 Gun, submachine, cal .45 ⁴	100	146	14,600	.40	-----	60	40
102 Launcher, grenade, cal .30, M7A1. ⁷	10	4	40	.06	5 cart	5 gren	5 ea cart & gren
103 Launcher, rocket, 3.5-inch.....	9	18	162	.76	-----	6	3
104 Mortar, 81-mm.....	99	1	99	.57	-----	60	39
105 Pistol, auto, cal .45.....	21	356	7,476	.21	21	-----	-----
106 Rifle, auto, cal .30.....	1,500	1	1,500	.06	60	480	960
107 Rifle, U. S., cal .30.....	120	19	2,280	.10	48	48	20
108 Demolition set, Nr 5.....		1	18 lbs. Negl. ⁷		X	-----	-----
109 Mines, AT, M7.....			200	.65	-----	-----	200
(For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs, 105- 107 and 110.)							
Total.....				5.94			

See footnotes at end of table.

b. Ammunition Supply Data—Armored Division—Continued

1	Weapon (unit)	2 Rds/ w/pn	3 No. of wpns ^{1,2} (T/O & E only)	4 Basic load for T/O & E wpns		5 How carried (rds per weapon) ³		
				a. Rds.	b. Tons	a. Ind.	b. Veh. ⁴	c. Tns.
	M TK BN, T/O & E 17-25N w/C1; 17-26N, w/C1, 2, & 3; 17-27N w/C1, 2, & 3:							
110	Carbine, cal .30.....	85	316	26,860	.44	45	15	25
111	Gun, machine, cal .30, hv.....	2,000	1	2,000	.08		1,000	1,000
112	Gun, machine, cal .30, flex.....	3,250	13	42,250	1.63		1,000	2,250
113	Gun, machine, cal .50, HB, flex.....	525	15	7,875	1.46		315	210
114	Gun, submachine, cal .45 ⁶	100	195	19,500	.54		60	40
115	Launcher, grenade, cal .30, M7A1. ⁷	10	4	40	.06	5 cart	5 gren	5 cart & gren
116	Launcher, rocket, 3.5-inch.....	9	23	207	.97		6	3
117	Mortar, 81-mm.....	99	1	99	.57		60	39
118	Pistol, auto, cal .45.....	21	391	8,211	.23	21		
119	Rifle, auto, cal .30.....	1,500	1	1,500	.06	60	480	960
120	Rifle, U. S., cal .30.....	104	28	2,912	.13	56		48
121	Demolition sct, Nr 5.....		1		Negl		1	
122	Mines, A.T, M7.....			200	.65			200
	(For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105-107 and 110.)							
	Total.....				6.82			
	HQ & HQ BTRY, DIV ARTY, ARMD DIV, T/O & E 6-160-IN, w/C1 & 2:							
123	Carbine, cal .30.....	90	94	8,460	.14	45	45	
124	Gun, machine, cal .50, HB, flex.....	525	3	1,575	.29		525	
125	Gun, submachine, cal .45 ⁶	100	37	3,700	.10	40	60	
126	Launcher, rocket, 3.5-inch.....	10	6	60	.28		10	
127	Pistol, auto, cal .45.....	21	46	966	.03	21		
	(For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105- 107 and 110.)							
	Total.....				.84			
	FA BN (105-mm HOW) SP, ARMD, T/O & E 6-165N, w/C1, 2; 6-166N, w/C1, 2; 6-167N w/C1, 2; 6-169N, w/C1, 2:							
128	Carbine, cal .30.....	90	411	36,990	.61	45	45	
129	Gun, machine, cal .50, HB, flex.....	525	14	7,350	1.36		525	
130	Gun, submachine, cal .45 ⁶	100	147	14,700	.40	40	60	
131	Launcher, rocket, 3.5-inch.....	12	39	468	2.20		12	
132	Pistol, auto, cal .45.....	21	126	2,646	.07	21		
	(For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105- 107 and 110.)							
	Total.....				4.64			

See footnotes at end of table.

b. Ammunition Supply Data—Armored Division—Continued

1	2	3	4		5		
			Basic load for T/O & E wpns		How carried (rds per weapon) ¹		
			a. Rds.	b. Tons	a. Ind.	b. Veh. ⁴	c. Tns.
	Weapon (unit)	Rds/ wpn	No. of wpns ¹ (T/O & E only)				
	FA BN (155-mm HOW) SP, ARMD, T/O & E 6-95N w/C1, 2; 6-96N, w/C1, 2; 6-197, w/C1, 2; 6-169, w/C1, 2:						
133	Carbine, cal .30.....	90	440	39,600	.65	45	45
134	Gun, machine, cal .50, HB, flex.....	525	13	6,825	1.26		525
135	Gun, submachine, cal .45.....	100	139	13,900	.38	40	60
136	Launcher, rocket, 3.5-inch.....	10	35	350	1.64		10
137	Pistol, auto, cal .45.....	21	113	2,373	.07	21	
	(For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105- 107 and 110.)						
	Total.....			4.00			
	AAA AW BN (SP), T/O & E 44- 75N; Chgs Nr 1; 44-76N, w/C1, 2; 44-77N, w/C1:						
138	Carbine, cal .30.....	90	508	45,720	.75	45	45
139	Gun, machine, cal .50, HB, flex.....	525	9	4,725	.87		525
140	Gun, submachine, cal .45.....	100	139	13,900	.38	40	60
141	Launcher, rocket, 3.5-inch.....	12	52	624	2.93		12
142	Pistol, auto, cal .45.....	21	3	63	Negl	21	
143	Demolition set, Nr 2.....		1	18 lbs.	Negl		X
	(For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105-107 and 110.)						
	Total.....			4.93			

Notes

¹ Weapons listed on standard nomenclature lists (SNL's) for vehicles as OVM equipment must be included in the computation of the total basic load of a unit. Necessary information is obtained from paragraph 107, or from appropriate SNL (or technical manual) if vehicle is not listed.

² Individual weapons computations are based on "Remarks" column contained in the latest changes to section II of the appropriate table of organization and equipment for those units for which such changes have been issued.

³ This column indicates a suggested distribution only, and is not restrictive.

⁴ Includes trailer with towing vehicle when appropriate.

⁵ In those units which contain no supply vehicles for the hauling of class V supply, but do contain combat vehicles, only "vehicular stowage capacity," of paragraph 107 is included in the basic load of the unit, and the ammunition listed in "Trains", paragraph 107, is not included.

⁶ Where vehicular stowage provides space for a greater number of rounds for gun, submachine, cal .45, than indicated in this table, the full stowage capacity will be used in computing the basic load of the unit.

⁷ "Rounds per weapon," includes both the cartridge and the grenade.

⁸ Weight of "explosives" only in demolition sets.

⁹ Weight of all explosives in battalion shown under "Explosives" includes the three types of demolition sets listed plus the supplementary set. The weight in column 4h includes 15% added for weight of containers. All other entries on this line are the weight of the explosive alone.

¹⁰ Additional transportation is required to transport this company. Organic transportation is inadequate.

¹¹ Ammunition for weapons in company headquarters is carried in "vehicle." For ammunition for weapons in replacement platoons, see note 10.

¹² Flares, smoke pots, grenades, etc., required by a unit above the storage capacity provided in combat vehicles, are not computed in this table.

¹³ Includes augmentation.

RESTRICTED—Security Information*c. Weight of Armored Division Basic Load of Ammunition (Based on Type Combat Vehicles)¹*

Unit	Wt. of basic load for T/O & E wpns (tons)	Wt. of basic load ¹ for typical SNL wpns (tons)	Total weight of unit basic load (tons)	Total wt. for div. (tons)
Hq & Hq Co, Armd Div, T/O & E 17-1N & 17-2N.....	2.90	7.70	10.60	10.60
Hq & Hq Co, CC or Res Comd T/O & E 17-20-1N.....	.91	5.71	6.62	6.62
Armd Sig Co, T/O & E 11-57N.....	3.13	4.38	7.51	7.51
Military Police Co, Armd Div, T/O & E 19-27N.....	1.25	.40	1.65	1.65
Hq & Hq Co, Div ths, Armd Div, T/O & E 17-60N & 17-60-1N.....	1.17	0	1.17	1.17
Band, Armd Div, T/O & E 20-107N.....	.10	0	.10	.10
QM Bn, Armd Div, T/O & E 10-45N.....	4.82	0	4.82	4.82
Ord Maint Bn, Armd Div, T/O & E 9-65N.....	7.19	0	7.19	7.19
Repl Co, Armd Div, T/O & E 20-7N.....	.74	0	.74	.74
Armd Engr Bn, T/O & E 5-215N.....	38.47	47.81	86.28	86.28
Ren Bn, Armd Div, T/O & E 17-45N.....	19.26	53.27	72.53	72.53
4 Armd Inf Bn (ea) T/O & E 7-25N.....	24.35	36.43	60.78	243.12
Hv Tk Bn, T/O & E 17-35N.....	5.94	203.32	209.26	209.26
3 M Tk Bn (ea), T/O & E 17-25N.....	6.82	211.91	218.73	656.19
Hq & Hq Btry Div Arty, Armd Div, T/O & E 6-160N and 6-160-1N.....	.84	1.19	2.03	2.03
3 Armd FA Bn, 105-mm How (ea) T/O & E 6-165N.....	4.64	139.20	143.84	431.52
Armd FA Bn, 155-mm How, T/O & E 6-195N.....	4.00	226.64	230.64	230.64
AAA AW Bn (SP), T/O & E 44-75N.....	4.93	132.57	137.50	137.50
Total Armd Div.....			2,109.47 tons	

¹ Following vehicles were used in computing these weights—information obtained from paragraph 108:

Tank, 76-mm gun, T41	Carrier, 81-mm mortar, half-track, M21
Tank, 90-mm gun, M47	Carriage, mtr, multiple gun (50 Cal AA) M16
Tank, 120-mm gun, T43	Carriage, mtr, twin 40-mm gun, M19
Tank, Med, M45	Carriage, mtr, 105-mm How, M37
Vehicle, Armored Infantry, full track, T18	Carriage, mtr, 155-mm How, M41
Vehicle, Tank Recovery, M32	

d. Weight of Basic Load of Ammunition for Armored Units Other Than Armored Division Units (Based on Type Vehicles)¹

Unit	Wt of basic load for T/O & E wpns (tons)	Wt of basic load for SNL wpns (tons)	Total wt for unit basic load (tons)
Hq & Hq Co, Armd Cav Regt. (L), T/O & E 17-5.....	2.03	7.30	9.33
Svc Co, Armd Cav Regt (L), T/O & E 17-53.....	7.26	4.31	11.57
3 Recon Bn, Armd Cav Regt (L), (ea) T/O & E 17-55.....	17.14	128.10	145.24
Total, Armd Cav Regt (L).....			164.14
Hq & Hq Co, Armd Gp, T/O & E 17-32.....	.60	1.19	1.79
Hv Tk Bn, T/O & E 17-35N.....	6.04	203.32	209.36
Amph Trac Bn, T/O & E 17-125.....	1.74	64.14	65.88
Amph Tk Bn, T/O & E 17-115.....	3.47	94.74	98.21
Recon Co, Airborne Div, T/O & E 17-77.....	8.14		8.14
Recon Co, Inf Div, T/O & E 17-57.....	3.10	12.53	15.63
Tk Co, (M) Inf Regt, T/O & E 17-37N.....	.40	57.86	58.26
M Tk Bn, Airborne or Inf Div, T/O & E 17-35N.....	6.04	184.58	190.62

¹ See note 1 on c above for other than amphibious vehicles. Amphibious vehicles used in computation were the LVT(A)5 and LVT(4).

112. Ammunition Supply Data—Infantry Division

a. Basic load.

1	2	3	4		5		
			Total basic load		How carried		
Weapon (unit)	Rounds per weapon	No. of weapons	Rounds	Tons	Individual	Vehicle	Trains
DIV HQ & HQ CO, T/O & E 7-2N, 7 July 48, MP CO, T/O & E 19-27N, 11 May 48, ORD Bn T/O & E 9-25, 5 May 48, SIG CO, T/O & E 11-7N, 3 May 48, BAND, T/O & E 20-107N, 22 Dec 47, QM CO, T/O & E 10-17N, 30 April 48 and REPL CO, T/O & E 20-7N, 3 May 48:							
2 Carbine, cal. .30.....	90	885	79,650	1.313	60	30	
3 Gun, machine, cal. .50.....	530	63	33,390	6.177		530	
4 Gun, submachine, cal. .45.....	90	156	14,040	.386	30	60	
5 Launcher, rocket, 3.5-incb.....	4	40	160	.750		4	
6 Pistol, cal. .45.....	21	261	5,481	.151	21		
7 Rifle, auto., cal. .30.....	500	3	1,500	.056	180	320	
8 Rifle, cal. .30.....	96	404	38,784	1.667	48	48	
9 Rifle, 75-mm.....	20	3	60	.655		20	
10 Explosives, etc.....				.134			
11 Grenades, hand.....			950	1.219		950	
12 Grenades, rifle.....			994	1.481		994	
13 Total.....				13.989			
RCN CO, INF DIV, T/O & E 17-57:*							
14 Carbine, cal. .30.....	90	64	5,760	.10	45	30	15
15 Gun, machine, cal. .30.....	2,000	9	18,000	.77		1,000	1,000
16 Gun, machine, cal. .50, HB, flex.....	630	3	1,890	.37		525	105
17 Gun, submachine, cal. .45 *.....	100	20	2,000	.06		60	40
18 Launcher, rocket, 3.5-inch.....	14	6	84	.74		12	2
19 Pistol, auto, cal. .45.....	21	35	735	.02	21		
20 Rifle, auto, cal. .30.....	1,000	3	3,000	.12	60	480	460
21 Rifle, U. S. cal. .30.....	120	61	7,320	.35	48	48	24
22 Demolition set, Nr 5 *.....		3	54 lbs	.03		X	
23 Mines, A T, M7.....			150	.54			150
(For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraph 105-107 and 110.)							
24 Total.....				3.10			
ENGINEER BATTALION, T/O & E 5-15N, 3 May 48:							
25 Carbine, cal. .30.....	90	133	11,970	.198	60		30
26 Gun, machine, cal. .30.....	2,815	36	101,268	3.898		2,065	750
27 Gun, machine, cal. .50.....	730	33	24,024	4.444		595	133
28 Gun, 76-mm Tk.....	80	5	400	5.800		71	9
29 Gun, submachine cal. .45.....	90	65	5,850	.165	60		30
30 Launcher, rocket 3.5-inch.....	12	40	480	2.251		6	6
31 Pistol, cal. .45.....	23	30	840	.023	21		7

*Includes augmentation.

For explanation of notes, see paragraph 111.

For total weight of basic load, see paragraph 111d.

RESTRICTED—Security Information*a. Basic load—Continued*

1	2	3	4		5		
			Total basic load		How carried		
Weapon (unit)	Rounds per weapon	No. of weapons	Rounds	Tons	Individual	Vehicle	Trains
ENGINEER BATTALION, T/O & E 5-15N, 3 May 48—Con.							
32 Rifle, cal. .30.....	96	729	69,984	3.009	48		48
33 Explosives 12,140 lbs plus 15% for container.....				6.978			
34 Flare, trip.....			520	1.158		420	100
35 Grenade, hand.....			1,153	1.400		580	573
36 Grenade, rifle.....			300	.420		200	100
37 Mine, AP.....			98	.481			98
38 Mine, AT.....			1,056	9.072		528	528
39 Total.....				37.926			
THREE INFANTRY REGIMENTS (EACH), T/O & E-7-11:							
40 Carbine, cal. .30.....	90	796	71,640	1.29	60		30
41 Gun, machine, cal. .30.....	3,270	81	264,870	11.39		2,438	833
42 Gun, machine, cal. .50.....	615	48	29,530	5.75		506	106
43 Gun, submachine, cal. .45.....	525	37	19,425	.55	60	405	60
44 Gun, 90-mm tank.....	70	22	1,540	49.66		40	30
45 Launcher, rocket: 3.5-inch.....	18	83	1,494	13.22		12	.6
46 Mortar: 60-mm.....	72	27	1,944	5.33		36	36
47 81-mm (H W Co).....	120	12	1,440	11.39		48	72
48 4.2-inch.....	144	12	1,728	29.635		74	70
49 Pistol, cal. .45.....	28	508	14,224	.40	21		
50 Rifle, cal. .30: Automatic.....	740	81	(286,348)	(13.27)			
51 M-1, M-1 C.....	104	2,177	59,940	2.52	380	60	300
52 Rifle, 57-mm.....	44	27	226,408	10.75	48	24	32
53 Rifle, 75-mm.....	42	12	1,188	6.35		28	16
54 Flares, trip.....			504	9.82		34	8
55 Grenades, hand.....			675	1.763			675
56 Grenades, rifle.....			2,419	1.483			2,419
57 Mines, AT, M-7.....			990	1.483			990
58 Total—One Regt.....			1,000	3.250			1,000
DIVISION ARTILLERY, T/O & E 6-100:							
59 Carbine, cal. .30.....	90	1,741	156,690	2.82	60		
60 Gun, antiaircraft, twin, 40-mm ea.....	720	32	23,040	100.22		560	160
61 Gun, machine, cal. .50.....	530	98	59,140	10.13		530	
62 Gun, AA, cal. .50 multiple mount 4 guns.....	7,200	32	231,400	45.12		5,880	1,320
63 Gun, submachine, cal. .45.....	90	459	41,310	1.18	60	30	
64 Howitzer, 105-mm.....	250	54	13,500	398.25		150	100
65 Howitzer, 155-mm.....	150	18	2,700	170.10		91	59
66 Launcher, rocket, 3.5-inch.....	6	210	1,260	11.15		6	
67 Pistol, cal. .45.....	21	58	1,218	.04	21		
68 Rifle, cal. .30, M1.....	72	1,239	89,208	4.24	48	24	
69 Total.....				743.25			

a. Basic load—Continued

1	2	3	4		5		
			Total basic load		How carried		
Weapon (unit)	Rounds per weapon	No. of weapons	Rounds	Tons	Individual	Vehicle	Trains
M TK BN, INF DIV, T/O & E 17-35:							
70 Carbine, cal. .30.....	85	283	24,055	.43	45	15	25
71 Gun, machine, cal. .30, flex.....	3,250	12	39,000	1.68	-----	1,000	2,250
72 Gun, machine, cal. .50, HB, flex.....	525	13	6,825	1.33	-----	525	-----
73 Gun, submachine, cal. .45 (6).....	100	159	15,900	.42	-----	60	40
74 Launcher, rocket, 3.5-inch.....	9	18	162	1.43	-----	6	3
75 Pistol, auto, cal. .45.....	21	357	7,497	.21	21	-----	-----
76 Rifle, auto, cal. .30.....	1,500	1	1,500	.06	60	480	960
77 Rifle, U. S., cal. .30.....	120	21	2,280	.12	48	48	20
78 Demolition set, Nr 5.....	-----	1	18 lbs.	Neg.	-----	X	-----
79 Mines, A.T., M7.....	-----	-----	200	.72	-----	-----	200
(For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105-107 and 110.)							
80 Total.....	-----	-----	-----	6.40	-----	-----	-----

For explanation of notes, see paragraph 111.

For total weight of basic load, see paragraph 111.

b. Other Units.

- (1) One-quarter ton trailers in weapons platoon are 50 percent overloaded (inf regt).
- (2) One-quarter ton trailers in 81-mm mortar squads are 25 percent overloaded (inf regt).
- (3) Two each 2½-ton trucks in battalion ammunition section are 50 percent overloaded (inf regt).
- (4) One and one-half ton trailers in mortar squads are 25 percent overloaded (inf regt).
- (5) Mortar Co Sec Regt Amm Tn is 20 percent overloaded (inf regt).
- (6) Two and one-half ton trucks with 1½-ton trailers in tank bns are 30 percent overloaded (tank bn).
- (7) Seventh section each 105-mm how. Btry are 20 percent overloaded (div arty).
- (8) Seventh section each 155-mm how. Bn Tns are 45 percent overloaded (div arty).

c. Resupply Capacity of Organic Ammunition Vehicles—Infantry Division.

1	2	3	4	5	6
Unit	Truck, 4-ton	Truck, 2½-ton	Trailer cargo 1½-ton	Trailer ammo 2-ton	Capacity (tons)
One infantry regiment.....		18	18		72
Three infantry regiments.....		54	54		216
One 105-mm How bn.....		21		21	94.5
Three 105-mm how bn.....		63		63	263.5
One 155-mm how Bn.....	9	15		24	121.5
AAAW Bn SP.....		12	12		48
Total Div Arty.....	9	90	12	87	453
Heavy Tank Bn.....		14	14		56
Total for Division.....	9	158	80	87	725

113. Ammunition Supply Data—Armored Cavalry Units

1	2	3 ¹	4		5 ²		
Weapon (unit)	Rds/ Wpn	Nr of Wpns ³ (T/O & E only)	Basic load for T/O & E Wpns		How Carried (Rds per weapon)		
			a. Rds	b. Tons	a. Ind	b. ⁴ Veh	c. Tns
HQ & HQ CO, ARMD CAV REGT (L), T/O & E 17-52, w/C1 & 2:							
1 Carbine, cal .30.....	90	66	5,940	.10	45	30	15
2 Gun, machine, cal .30, flex.....	2,000	4	8,000	.31		1,000	1,000
3 Gun, machine, cal .50, HB, flex.....	525	3	1,575	.29		420	105
4 Gun, submachine, cal .45 ⁶	160	45	7,200	.20	40	60	60
5 Launcher, rocket, 3.5-inch.....	12	11	132	.62		6	6
6 Pistol, auto, cal .45.....	21	23	483	.01	21		
7 Rifle, auto, cal .30.....	1,500	3	4,500	.17	60	480	960
8 Rifle, U. S., cal .30.....	120	63	7,560	.33	48	48	24
(For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105-107 and 110.)							
9 Total.....				2.03			
SVC CO, ARMD CAV REGT (L), T/O & E 17-53, w/C1 & 2:							
10 Carbine, cal .30.....	90	87	7,830	.13	45	30	15
11 Gun, machine, cal .30, flex.....	4,000	17	68,000	2.62		2,000	2,000
12 Gun, machine, cal .50, HB, flex.....	840	17	14,280	2.64		672	168
13 Gun, submachine, cal .45 ⁶	160	93	14,880	.41	45	60	55
14 Launcher, rocket, 3.5-inch.....	12	20	240	1.13		6	6
15 Pistol, auto, cal .45.....	21	1	21		21		
16 Rifle, U. S., cal .30 (Sniper's).....	120	64	7,680	.33	48	48	24
(For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105-107 and 110.)							
17 Total.....				7.26			

For explanation of notes, see paragraph 111. For total weight of basic load, see paragraph 111d.

113. Ammunition Supply Data—Armored Cavalry Units—Continued

	1 Weapon (unit)	2 Rds/ Wpn	3 ¹ Nr of Wpns ¹ (T/O & E only)	4 Basic load for T/O & E Wpns		5 ² How Carried (Rds per weapon)		
				a. Rds	h. Tons	a. Ind	b. ⁴ Veh	c. Tns
	ARMD CAV RCN BN, ACR (L), T/O & E 17-55, w/C1; 17-56, w/C1, 2, 3; 17-57N, w/C1, 2; 17-27N, w/ C1, 2, 3; 6-167N, w/C1, 2:							
18	Carbine, cal .30.....	90	327	29,430	.49	45	30	15
19	Gun, machine, cal .30, hv.....	2,000	9	18,000	.69		1,000	1,000
20	Gun, machine, cal .30, flex.....	4,000	21	84,000	3.23		1,500	2,500
21	Gun, machine, cal .50, HB, flex.....	840	16	13,440	2.49		525	315
22	Gun, submachine, cal .45 ⁴	160	123	19,680	.54	40	60	60
23	Launcher, grenade, cal .30, M7A1. ⁷	6	36	216	.32	5 cart	5 gren	1 ea cart & gren
24	Launcher, rocket, 3.5-inch.....	12	34	408	1.91		6	6
25	Mortar, 81-mm.....	112	9	1,008	5.85		60	52
26	Pistol, auto, cal .45.....	21	227	4,767	.13	21		
27	Rifle, auto, cal .30.....	1,000	9	9,000	.34	60	480	460
28	Rifle, U. S., cal .30.....	120	222	26,640	1.15	48	48	24
29	Demolition set, Nr 5.....		3	18 lbs	Negl		X	
	(For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105-107 and 110.)							
30	Total.....				17.14			
	HQ & HQ CO, ARMORED CAV- ALRY GROUP, T/O & E 17-32 w/C2:							
31	Carbine, cal .30.....	90	49	4,410	.073	45	30	15
32	Gun, machine, cal .50, HB, flex.....	525	2	1,050	.194		420	105
33	Gun, submachine, cal .45 ⁴	160	14	2,240	.061	40	60	60
34	Launcher, grenade, cal .30, M7A1. ⁷	6	2	12	.02	5 cart	5 gren	1 ea cart & gren
35	Launcher, rocket, 3.5-inch.....	12	4	48	.23		6	6
36	Pistol, auto, cal .45.....	21	7	147	Negl	21		
37	Rifle, U. S. cal .30.....	120	5	600	.03	48	48	24
	(For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105-107 and 110.)							
38	Total.....				0.60			
	HV TK BN, T/O & E 17-35N, w/C1, 2, 3, 4; 17-36N, w/C1, 2, 3, 4; 17-37N, w/C1, 2:							
39	Carbine, cal .30.....	85	292	24,820	.41	45	15	25
40	Gun, machine, cal .30, hv.....	2,000	1	2,000	.03		1,000	1,000
41	Gun, machine, cal .30, flex.....	3,250	11	35,750	1.38		1,000	2,250
42	Gun, machine, cal .50, HB, flex.....	525	14	7,350	1.36		525	
43	Gun, submachine, cal .45 ⁴	100	147	14,700	.40		6	40
44	Launcher, grenade, cal .30, M7A1. ⁷	10	4	40	.06	5 cart	5 gren	5 ea cart & gren

For explanation of notes, see paragraph 111. For total weight of basic load, see paragraph 111d.

113. Ammunition Supply Data—Armored Cavalry Units—Continued

1 Weapon (unit)	2 Rds/ Wpn	3 ¹ Nr of Wpns ² (T/O & E only)	4 Basic load for T/O&E Wpns		5 ³ How Carried (Rds per weapon)		
			a. Rds	b. Tons	a. Ind	b. ⁴ Veh	c. Tns
HV TK BN, T/O & E 17-35N— Continued							
45 Launcher, rocket, 3.5-inch.....	9	18	162	.76		6	3
46 Mortar, 81-mm.....	99	1	99	.57		60	39
47 Pistol, auto, cal .45.....	21	357	7,497	.21	21		
48 Rifle, auto, cal .30.....	1,500	1	1,500	.06	60	480	960
49 Rifle, U. S. cal .30.....	120	19	2,280	.10	48	48	20
50 Demolition set, Nr 5.....		1	18 lbs	Negl		X	
51 Mines, A T, M7.....			200	.65			200
(For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105-107 and 110.)							
52 Total.....				6.04			
AMPHIBIOUS TRAC BN, T/O & E 17-125; 17-126, w/C1; 17-127:							
53 Carbine, cal .30.....	90	337	20,330	.50	45	45	
54 Gun, machine, cal .50, HB, flex.....	525	4	2,100	.39		525	
55 Gun, submachine, cal .45 ⁶	100	13	1,300	.04	40	60	
56 Launcher, rocket, 3.5-inch.....	12	11	132	.62		12	
57 Pistol, auto, cal .45.....	21	332	6,972	.19	21		
(For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105-107 and 110.)							
58 Total.....				1.74			
AMPHIBIOUS TANK BN, T/O & E 17-115, w/C1, 2; 17-116, w/C1, 2; 17-117, w/C1, 2:							
59 Carbine, cal .30.....	90	331	29,790	.49	45	45	
60 Gun, machine, cal .50, HB, flex.....	525	8	4,200	.78		525	
61 Gun, submachine, cal .45 ⁶	100	158	15,800	.43	40	60	
62 Launcher, grenade M8.....	5	64	320	.48	5 cart	5 gren	
63 Launcher, rocket, 3.5-inch.....	12	19	228	1.07		12	
64 Pistol, auto, cal .45.....	21	375	7,875	.22	21		
(For flares, grenades, etc., and all ammunition for all SNL weapons, see paragraphs 105-107 and 110.)							
65 Total.....				3.47			

For explanation of notes, see paragraph 111. For total weight of basic load, see paragraph 111d.

114. Ammunition Supply Data—Artillery Units

a. Basic Load.

(1) Field Artillery.

1	2	3	4		5		
			Total basic load		How carried		
Weapon (unit)	Rounds per weapon	Number of weapons	Rounds	Tons	Individual	Vehicle	Trains
HQ & HQ BTRY, FA GP, T/O & E 6-12, 2 Dec 48:							
Carbine, cal. .30.....	90	114	10,800	0.19	45	45	
Gun, machine, cal. .50.....	530	6	3,180	.59		530	
Launcher, rocket, 3.5 inch.....	6	6	36	.17	6		
Pistol, automatic, cal. .45.....	21	11	2,000	.06	21		
Total.....				1.01			
HQ & HQ BTRY, CORPS ARTY, T/O & E 6-50-1, 20 Oct 44, C-2:							
Carbine, cal. .30.....	90	75	8,100	.14	45	45	
Gun, machine, cal. .50.....	530	2	1,060	.20		530	
Launcher, rocket, 2.36-inch.....	8	6	60	.20	8		
Pistol, automatic, cal. .45.....	21	37	2,000	.06	21		
Total.....				.60			
FA BN, 75-mm HOW PK, MOUNTAIN, T/O & E 6-185, 4 Nov 44, C-1:							
Carbine, cal. .30.....	90	531	54,000	.92	45	45	
Rifle, automatic, cal. .30.....	740	15	13,200	.41	100	640	
Pistol, automatic, cal. .45.....	21	3	2,000	.06	21		
Gun, submachine, cal. .45.....	90	3	6,000	.17	45	45	
Gun, machine, cal. .50.....	530	9	4,770	.88		530	
Howitzer, pack, 75-mm.....	63	12	756	9.45		36	27
Total.....				11.89			
FA BN, 75-mm PK HOW, TRK-DR, T/O & E 6-175, 28 Jul 43, C-3:							
Carbine, cal. .30.....	90	333	32,400	.55	45	45	
Gun, machine, cal. .50.....	530	8	4,240	.78		530	
Howitzer, 75-mm pack.....	30	12	360	4.50		10	20
Launcher, rocket, 2.36-inch.....	8	16	160	.52	8		
Pistol, automatic, cal. .45.....	21	57	8,000	.22	21		
Total.....				6.57 (11.07)			
FA BN, 105-mm HOW, TRK-DR, T/O & E 6-25N, 21 Apr 48:							
Carbine, cal. .30.....	90	509	51,300	.87	45	45	
Gun, machine, cal. .50.....	530	23	12,190	2.24		530	
Gun, submachine, cal. .45.....	90	3			45	45	
Howitzer, 105-mm.....	250	18	4,500	110.25		60	190
Launcher, rocket, 3.5-inch.....	6	46	276	1.30	6		
Pistol, automatic, cal. .45.....	21	110	10,000	.28	21		
Total.....				114.94			

a. Basic Load—Continued
(1) Field Artillery—Continued.

1	2	3	4		5		
			Total basic load		How carried		
Weapon (unit)	Rounds per weapon	Number of weapons	Rounds	Tons	Individual	Vehicle	Trains
FA BN, 105-mm HOW, TRAC-DR, T/O & E 6-325, 1 Jun 45, C-1:							
32 Carbine, cal. .30.....	90	435	45,900	.78	45	45	
33 Gun, machine, cal. .50.....	530	21	11,130	2.05		530	
34 Gun, submachine, cal. .45.....	90	3			45	45	
35 Howitzer, 105-mm.....	250	12	3,000	73.50		56	104
36 Launcher, rocket, 2.36-inch.....	8	40	380	1.22	8		
37 Pistol, automatic, cal. .45.....	21	68	10,000	.28	21		
38 Total.....				77.83			
FA BN, 155-mm HOW, TRAC-DR, T/O & E 6-335N, 12 May 48:							
39 Carbine, cal. .30.....	90	535	59,400	1.00	45	45	
40 Gun, machine, cal. .50.....	530	23	12,190	2.25		530	
41 Gun, submachine, cal. .45.....	90	3			45	45	
42 Howitzer, 155-mm.....	150	18	2,700	155.25		24	126
43 Launcher, rocket, 3.5-incb.....	6	46	276	1.30	6		
44 Pistol, automatic, cal. .45.....	21	106	10,000	.28	21		
45 Total.....				160.08			
FA BN, 155-mm GUN, TRK-DR, T/O & E 6-55, 31 Jan 46, C-1:							
46 Carbine, cal. .30.....	90	478	45,900	.78	45	45	
47 Gun, machine, cal. .50.....	530	19	10,070	1.86		530	
48 Gun, submachine, cal. .45.....	90	3			45	45	
49 Gun, 155-mm.....	120	12	1,440	138.24		20	100
50 Launcher, rocket, 2.36-inch.....	8	34	340	1.09	8		
51 Pistol, automatic, cal. .45.....	21	63	10,000	.28	21		
52 Total.....				142.25			
FA BN, 8-IN HOW, TRK-DR, T/O & E 6-65, 31 Jan 46:							
53 Carbine, cal. .30.....	90	505	54,000	.92	45	45	
54 Gun, machine, cal. .50.....	530	19	10,070	1.86		530	
55 Gun, submachine, cal. .45.....	90	3			45	45	
56 Howitzer, 8-inch.....	100	12	1,200	141.60		20	80
57 Launcher, rocket, 2.36-inch.....	8	34	340	1.09	8		
58 Pistol, automatic, cal. .45.....	21	63	10,000	.28	21		
59 Total.....				145.75			
FA BN, 155-mm GUN, TRAC-DR, T/O & E 6-355, 31 Jan 46, C-1:							
60 Carbine, cal. .30.....	90	486	45,900	.78	45	45	
61 Gun, machine, cal. .50.....	530	19	10,070	1.86		530	
62 Gun, submachine, cal. .45.....	90	3			45	45	
63 Gun, 155-mm.....	120	12	1,440	138.24		30	90
64 Launcher, rocket, 2.36-incb.....	8	34	340	1.09	8		
65 Pistol, automatic, cal. .45.....	21	63	10,000	.28	21		
66 Total.....				142.25			

a. Basic Load—Continued
(1) Field Artillery—Continued

1	Weapon (unit)	2 Rounds per weapon	3 Number of weapons	4 Total basic load		5 How carried		
				Rounds	Tons	Individual	Vehicle	Trains
	FA BN, 8-IN HOW, TRAC-DR, T/O & E 6-365, 31 Jan 46:							
67	Carbine, cal. .30.....	90	513	54,000	.92	45	45	
68	Gun, machine, cal. .50.....	530	19	10,070	1.86		530	
69	Howitzer, 8-inch.....	100	12	972	114.70		20	80
70	Launcher, rocket, 2.36-inch.....	8	34	340	1.09	8		
71	Pistol, automatic, cal. .45.....	21	63	10,000	.28	21		
72	Total.....				118.85			
	FA OBSERVATION BN, T/O & E 6-75, 16 Nov 48:							
73	Carbine, cal. .30.....	90	801	75,600	1.28	45	45	
74	Gun, machine, cal. .50.....	530	26	13,780	2.54		530	
75	Gun, submachine, cal. .45.....	90	12			45	45	
76	Launcher, rocket, 3.5-inch.....	6	34	204	.96	6		
77	Pistol, automatic, cal. .45.....	21	8	8,000	.22	21		
78	Total.....				5.00			
	FA BN, 4.5-INCH ROCKET, TRK- DR, T/O & E 6-85, 5 Jan 49:							
79	Carbine, cal. .30.....	90	536	51,300	.87	45	45	
80	Gun, machine, cal. .50.....	530	23	12,190	2.24		530	
81	Launcher, rocket, 3.5-inch.....	6	28	168	.79	6		
82	Launcher, rocket, multiple 4.5- inch (24 tube).....	72	36	2,592	58.32		24	48
83	Pistol, automatic, cal. .45.....	21	7	8,000	.27	21		
84	Total.....				62.49			
	FA BN 8-INCH HOW, SP, T/O & E 6-465, 19 Sep 45:							
85	Carbine, cal. .30.....	90	488	48,600	.82	45	45	
86	Gun, machine, cal. .50.....	530	19	10,070	1.86		530	
87	Gun, submachine, cal. .45.....	90	3			45	45	
88	Howitzer, 8-inch, motor carriage.....	148	12	1,776	209.57		12	136
89	Launcher, rocket, 2.36-inch.....	8	34	340	1.09	8		
90	Pistol, automatic, cal. .45.....	21	64	10,000	.28	21		
91	Total.....				213.62			
	FA BN, 240-mm HOW, OR 8-IN GUN, TRAC-DR, T/O & E 6-395, 31 Jan 46:							
92	Carbine, cal. .30.....	90	432	45,900	.78	45	45	
93	Gun, machine, cal. .50.....	530	19	10,070	1.86		530	
94	Howitzer, 240-mm..... or	100	6	600	139.50		28	72
95	Gun, 8-inch.....	100	6	600	115.80		28	72
96	Launcher, rocket, 2.36-inch.....	8	28	280	.90	8		
97	Pistol, automatic, cal. .45.....	21	63	10,000	.28	21		
98	Total, 240-mm how Bn.....				143.32			
99	Total, 8-inch gun Bn.....				119.62			

a. Basic Load—Continued
(1) Field Artillery—Continued

1	2	3	4		5		
			Total basic load		How carried		
Weapon (unit)	Rounds per weapon	Number of weapons	Rounds	Tons	Individual	Vehicle	Trains
FA BN, 155-mm GUN, SP, T/O & E 6-455, 7 Sep 45:							
100 Carbine, cal. .30.....	90	461	48,600	.82	45	45	-----
101 Gun, machine, cal. .50.....	530	19	10,070	1.86	-----	530	-----
102 Gun, submachine, cal. .45.....	90	3	-----	-----	45	45	-----
103 Gun, 155-mm motor carriage.....	173	12	2,076	119.30	-----	20	153
104 Launcher, rocket, 2.36-inch.....	8	34	340	1.09	8	-----	-----
105 Pistol, automatic, cal. .45.....	21	64	10,000	.28	21	-----	-----
106 Total.....	-----	-----	-----	203.35	-----	-----	-----

(2) Antiaircraft Artillery.

HQ & HQ BTRY, AAA BRIG, T/O & E 44-10-1, 21 Oct 48:							
2	Carbine, cal. .30.....	90	80	7,200	.119	45	45
3	Pistol, cal. .45.....	21	8	168	.005	21	-----
4	Gun, submachine, cal. .45.....	90	17	1,530	.042	45	45
5	Gun, machine, cal. .50.....	530	6	3,180	.584	-----	3,180
6	Launcher, grenade.....	10	6	60	.090	-----	60
7	Launcher, rocket.....	6	4	24	.113	-----	24
8	Grenades, fragmentation.....	-----	-----	50	.053	-----	50
9	Total.....	-----	-----	-----	1.006	-----	-----
HQ & HQ BTRY, AAA GP, T/O & E 44-12, 8 Oct 48:							
10	Carbine, Cal. .30.....	90	78	7,020	.116	45	45
11	Pistol, cal. .45.....	21	7	147	.004	21	-----
12	Gun, submachine, cal. .45.....	90	19	1,710	.047	45	45
13	Gun, machine, cal. .50.....	530	6	3,180	.584	-----	3,180
14	Launcher, grenade.....	10	6	60	.090	-----	60
15	Launcher, rocket.....	6	4	24	.113	-----	24
16	Grenade, fragmentation.....	-----	-----	50	.053	-----	50
17	Total.....	-----	-----	-----	1.007	-----	-----
AAA OPR DET, T/O & E 44-7, 15 Oct 48:							
18	Carbine, cal. .30.....	90	46	4,140	.068	45	45
19	Pistol, cal. .45.....	21	1	21	-----	21	-----
20	Gun, submachine, cal. .45.....	90	9	810	.022	45	45
21	Gun, machine, cal. .50.....	530	3	1,590	.292	-----	1,590
22	Launcher, grenade.....	10	2	20	.030	-----	20
23	Launcher, rocket.....	6	2	12	.056	-----	12
24	Grenade, fragmentation.....	-----	-----	25	.027	-----	25
25	Total.....	-----	-----	-----	.495	-----	-----

a. Basic Load—Continued
(2) Antiaircraft Artillery—Continued

1	2	3	4		5		
			Total basic load		How carried		
Weapon (unit)	Rounds per weapon	Number of weapons	Rounds	Tons	Individual	Vehicle	Trains
AAA GUN BN (90-mm) T/O & E 44-15, 5 Oct 48:							
26 Carbine, cal. .30.....	90	647	58,230	.961	45	45	19,410
27 Pistol, cal. .45.....	21	3	63		21		
28 Gun, submachine, cal. .45.....	90	135	12,150	.334	45	45	4,050
29 Gun, machine, cal. .50 (flexible).....	530	46	24,380	4.510		24,380	
30 Mount, multiple (4), MG, cal. .50, M-55.....	4,240	16	67,840	12.467		55,120	12,720
31 Gun, 90-mm.....	175	16	2,800	95.200		2,480	320
32 Launcher, grenade.....	10	50	500	.750		500	
33 Launcher, rocket.....	12	22	264	1.238		264	
34 Grenade, fragmentation.....			400	.424		400	
35 Total.....				115.884			
AAA GUN BN (120-mm) ¹ T/O & E 44-115, 8 Oct 49:							
36 Carbine, cal. .30.....	90	634	57,060	.941	45	45	
37 Pistol, cal. .45.....	21	3	63		21		
38 Gun, submachine, cal. .45.....	90	69	6,210	.171	45	45	
39 Gun, machine, cal. .50.....	530	25	13,250	2.451		13,250	
40 Mount, multiple (4) MG, cal. .50, M-55.....	4,240	16	67,840	12.467		67,840	
41 Gun, 120-mm.....	90	16	1,440	104.400		640	800
42 Launcher, grenade.....	10	50	500	.750		500	
43 Launcher, rocket.....	6	22	132	.619		132	
44 Grenade, fragmentation.....			200	.212		200	
45 Total.....				122.011			
AAA AUTO WPNS BN, MOB, T/O & E 44-25, 4 Oct 48:							
46 Carbine, cal. .30.....	90	784	70,560	1.164	45	45	23,520
47 Pistol, cal. .45.....	21	3	63		21		
48 Gun, submachine, cal. .45.....	90	155	13,950	.384	45	45	4,650
49 Gun, MG, cal. .50 (flexible).....	530	30	15,900	2.942		15,900	
50 Mount, multiple (4) MG, cal. .50, M-55.....	6,000	32	192,125	35.307		153,700	38,425
51 Gun, 40-mm.....	300	32	9,600	31.800		7,680	1,920
52 Launcher, grenade.....	10	44	440	.660		440	
53 Launcher, rocket, 3.5-inch.....	6	52	312	1.463		312	
54 Grenade, fragmentation.....			400	.424		400	
55 Total.....				74.144			

¹ AAA Gun Bn (120-mm), T/O & E 44-115, is semimobile with sufficient organic transportation to move a single battery as a unit. Therefore, ammunition for only 1 battery can be transported at one time with the organic transportation.

a. Basic Load—Continued

(2) Antiaircraft Artillery—Continued

1	2	3	4		5		
			Total basic load		How carried		
Weapon (unit)	Rounds per weapon	Number of weapons	Rounds	Tons	Individual	Vehicle	Trains
AAA AUTO WPNS BN, SP, T/O & E 44-75N, 28 Apr 48:							
56 Carbine, cal. .30.....	90	630	56,700	.936	45	45	18,900
57 Pistol, cal. .45.....	21	3	63		21		
58 Gun, submachine, cal. .45.....	90	139	12,510	.344	45	45	4,170
59 Gun, machine, cal. .30.....	3,000	18	54,000	2.079		36,000	18,000
60 Gun, machine, cal. .50 (flexible).....	530	27	14,310	2.630		14,310	
61 Carriage, motor, multiple (4) MG, cal. .50, M-16.	7,200	32	230,550	42.369		188,150	42,400
62 Carriage, motor, twin 40-mm gun, M-19.	720	32	23,040	76.320		17,920	5,120
63 Launcher, grenade.....	10	81	810	1.215		810	
64 Grenades, fragmentation.....			1,000	1.060		1,060	
65 Mortar, 81-mm.....	30	1	30	.168		30	
66 Total.....				127.121			
ABN AA BN, T/O & E 44-275 (PROPOSED):							
67 Carbine, cal. .30.....	90	473	43,020	.792	45	45	
68 Pistol, cal. .45.....	21	549	11,529	.328	21		
69 Gun, submachine, cal. .45.....	90	68	6,120	.079	45	45	
70 Gun, machine, cal. .50 (flexible).....	530	52	27,560	5.065		530	
71 Mount, tr, multiple MG (4), M-55.	5,300	24	127,200	23.376		76.320	50,880
72 Gun, 40-mm.....	264	24	6,336	20.988		3,456	2,880
73 Launcher, grenade.....	10	55	550	.825		550	
74 Launcher, rocket.....	12	56	672	3.152		672	
75 Grenade, fragmentation.....			1,000	1.060		1,000	
76 Total.....				55.665			

b. *Resupply Capacity, Organic Ammunition Vehicles* (prime movers of weapons and weapon carriers not included).

	1	2	3	4	5	6	7	8	9	10	11	12
1	Unit	Pack mule (10-ton each)	Truck, 2½-ton, and trailer, M-10 ¹	Vehicle, utility, armored, M44 ² and trailer, M10 ¹	Tractor, M5, ³ and trailer, M10 ¹	Truck, 4-ton, and trailer, M-10 ¹	Tractor, M-4, ⁴ and trailer, M23 ⁵ (8-ton)	Vehicle, utility, armored, M44 ² and trailer, M21 ⁶ (4-ton)	Truck, 2½-ton, and trailer, 1-ton	Truck, 7½-ton, and trailer, M23 ⁵ (8-ton)	Tractor, M-6 ⁷ and trailer, M23 ⁵ (8-ton)	Capacity (tons)
2	Fa bn, 75-mm howitzer, pack.....	84										8.4
3	Fa bn, 105-mm howitzer, tractor.....		9		6							51.3
4	Fa bn, 105-mm howitzer, truck.....		21									81.3
5	Fa bn, 105-mm howitzer, sp, armored.....		12	9								
6	Fa bn, 4.5-in. rocket, truck.....								9			31.5
7	Fa bn, 155-mm howitzer, tractor.....		12		3	9						103.0
8	Fa bn, 155-mm howitzer, truck.....		15									58.1
9	Fa bn, 155-mm howitzer, sp, armored.....		12					18				118.0
10	Fa bn, 155-mm gun, tractor.....		3				6					71.9
11	Fa bn, 155-mm gun, truck.....		3							6		104.6
12	Fa bn, 155-mm gun, sp.....		6									23.2
13	Fa bn, 8-in. howitzer, tractor.....		3				6					73.8
14	Fa bn, 8-in. howitzer, truck.....		3							6		104.6
15	Fa bn, 8-in. howitzer, sp.....						12			6		217.3
16	Fa bn, 8-in., gun or 240-mm howitzer ⁸		3								12	163.4

¹ Trailer, M-10, carries 1.37 tons ammunition. (56 rounds 105-mm, 23 rounds 155-mm).

² Vehicle, utility, armored, M44, under development. Estimate no cargo capacity.

³ Tractor, M5, carries 24 rounds 155-mm ammunition (1.38 tons), 58 rounds 105-mm (1.38 tons).

⁴ Tractor, M4, carries 30 rounds 155-mm (2.05 tons) or 20 rounds 8-in. howitzer ammunition (2.36 tons).

⁵ Trailer, M23, figures based on full tonnage capacity (8 tons).

⁶ Trailer, M21, figures based on full tonnage capacity (4 tons).

⁷ Tractor, M6, carries 24 rounds 8-in. gun or 24 rounds 240-mm ammunition (4.65 tons).

⁸ Estimate only. No current authorized T/O & E.

RESTRICTED—Security Information

114

RESTRICTED

275

115. Ammunition Supply Data—Chemical Units

	1	2	3	4		5		
1	Weapon (unit)	Rounds per weapon	Number of weapons	Total basic load		How carried		
				Rounds	Tons	Individual	Vehicle	Trains
	HQ & HQ DET, CML SMOKE GENR BN, T/O & E 3-266, 11 Mar 49:							
2	Carbine, cal. .30	90	18	1,620	0.3	60		30
3	Pistol, automatic, cal. .45	21	2	42		21		
4	Rifle, US, cal. .30	96	4	384	.018	48	43	
5	Total				.318			
	CML SMOKE GENR CO: T/O & E 3-267, 11 Mar 49:							
6	Carbine, cal. .30	90	127	11,430	2.2	60		30
7	Gun, machine, cal. .50	530	5	2,650	.1		530	
8	Launcher, grenade, cal. .30, M7A1	10	7	70	.1		10	
9	Launcher, grenade, M8		12					
10	Launcher, rocket, 3.5 in.	6	4	24			6	
11	Rifle, automatic, cal. .30 Browning	500	2	1,000	.04	180	320	
12	Rifle, US, cal. .30	96	21	2,016	.07	48	48	
13	Generator, smoke, mechanical, M2A1. ¹	4	48	192	43.76	24	168	
14	Total				46.27			

¹ A single mechanical smoke generator operating at maximum capacity consumes approximately 1,200 gallons of fog oil per 24-hour day.

² 55-gallon drums

116. Ammunition Supply Data—Engineers

1	2 Weapon (unit)	3 Rounds per weapon	4 Number of weapons	5 Total basic load		6 How carried		
				Rounds	Tons	Indi- vidual	Vehicle	Trains
	ENGR COMBAT BN, ARMY T/O & E 5-35:							
2	Carbine, cal. .30, M2	60	99	5,940	0.098	60		50
3	Flare, trip, M49			275	.325		225	50
4	Flare, trip, parachute, M48			140	.616		90	50
5	Grenade, fragmentation			525	.557		225	300
6	Grenade, fragmentation, offensive			378	.500		162	216
7	Grenade, hand, incendiary			16	.025			16
8	Grenade, hand, smoke, WP, M15			64	.100		48	16
9	Grenade, smoke, colored M18			25	.027			25
10	Gun, machine, cal. .30, Browning, M1919A4, flexible.	1,000	20	20,000	.770		1,000	
11	Gun, machine, cal. .50, HB, flexible.	530	18	9,540	1.800		530	
12	Gun, submachine, cal. .45, M3A1	90	40	3,600	.220	60	30	
13	Launcher, rocket, 3.5-in, M20	12	31	372	1.745		31	
14	Mine, AP, M2A3			50	.192			50
15	Mine, AP, M3			48	.293			48
16	Mine, AT, HE, HV M6			420	6.300		180	240
17	Mine, AT, HE, L M7A1			504	1.638		216	288
18	Pistol, automatic, cal. .45	21	4	84	.002	21		
19	Rifle, US, cal. .30, M1	96	559	53,664	2.400	48	4,472	33,360
20	Total				15.988			

117. Ammunition Supply Data—Signal Corps

1	2 Weapon (unit)	3 Rounds per weapon	4 Number of weapons	5 Total basic load		6 How carried		
				Rounds	Tons	Indi- vidual	Vehicle	Trains
	SIGNAL BN CORPS T/O & E 11-15N:							
2	Carbine, cal. .30 M2	60	1,041	62,460	1.000	60		
3	Gun, submach, cal. .45	90	33	2,970	.090	60	30	
4	Pistol, cal. .45	21	12	252	.006	21		
5	Rifle, cal. .30 M1	96	99	9,504	.350	48	48	
6	Grenades, hand, assorted.							
7	Total				1.446			

118. Ammunition Supply Data—Service Units

For planning purposes, assume service units not likely to become involved in direct combat with the enemy, to carry a basic load of ammunition as follows:

1	1	2
	Weapon	Rounds per weapon
2	Carbine, cal. 30.....	60
3	Rifle, cal. 30.....	96
4	Weapons to be used against hostile aircraft ¹	530

¹ Machine guns, cal. .50 and cal. .30.

Section VI. MISCELLANEOUS SUPPLY**119. Water Supply***a. Water Requirements.*

	1	2	3	4
1	Unit consumer	Conditions of use	Gallons per unit consumer per day ¹	Remarks
2	Man.....	In combat: Minimum.....	1/4-1.....	For periods not exceeding 3 days when operational rations are used.
		Normal.....	2.....	When field rations are used.
		March or bivouac.....	3.....	Drinking plus small amount for cooking or personal hygiene.
		Temporary camp.....	2.....	Minimum for all purposes.
		Temporary camp with bathing facilities.	5.....	Desirable for all purposes (does not include hathing).
		Semipermanent camp.	15.....	Includes allowance for water-borne sewage system.
		Permanent camp.....	30-60.....	
			60-100.....	
3	Horse or mule.....	Minimum.....	3-5.....	Drinks from 3-5 gallons at a watering and requires 5 minutes to drink.
4	Vehicle.....	Level and rolling country..	1/8-1/2.....	Depending on size of vehicle.
		Mountainous country.....	1/4-1.....	Depending on size of vehicle.
5	Locomotive.....	Standard military.....	Variable.....	150 gallons per train mile.
		Commercial.....	Variable.....	200 gallons per train mile.
6	Hospital.....	Drinking and cooking.....	10 per bed.....	Minimum, does not include bathing or water for flushing.
		With water-borne sewage..	50 per bed.....	Includes water for medical personnel.
7	Smoke generator, M2.	Semimobile.....	150 gallons per day universally.	
8	Impregnating plant, clothing M2.	Maximum impregnating capacity.	3,000.....	Suspension process.

¹ In hot climates, maximum requirements may exceed values given by 15 to 100 percent.

b. Water Equipment Issued to Engineer Units.

Unit	Number of sets (Each set can equip one water point)	Equipment in each set			Total gallons per minute		Storage capacity gallons ²	Maximum daily production gallons ²	Water transport equipment
		Filter	Pump (gpm)	Tanks (gal)	Pump- ing ¹	Filtering			
Engr c bn.....	4	35 gpm portable diatomite...	4-55	3-3,000	800	140	12,000	168,000	18 700-gal tankers. 6 1,500-gal semi-trailers.
Armd engr bn.....	4	35 gpm portable diatomite...	4-55	3-3,000	800	140	12,000	168,000	
Abn engr bn.....	4	35 gpm portable diatomite...	4-55	3-3,000	800	140	12,000	168,000	
Engr boat and shore rogt.....	2	35 gpm portable diatomite...	4-55	3-3,000	400	70	6,000	84,000	
Engr cons bn.....	2	35 gpm portable diatomite...	4-55	3-3,000	400	70	6,000	84,000	
Engr topo bn, army.....	1	15 gpm pack diatomite.....	2-30	4- 500	45	15	500	18,000	
Engr topo co, corps.....	1	15 gpm pack diatomite.....	2-30	4- 500	45	15	500	18,000	
Engr survey bn.....	1	15 gpm pack diatomite.....	2-30	4- 500	45	15	500	18,000	
Engr w sup com.....	0	50 gpm portable diatomite...	5-55	4-3,000	2,295	450	27,000	540,000	
Engr w sup team CA.....	1	15 gpm pack diatomite.....	2-30	4- 500	45	15	500	18,000	
Engr w sup team CB.....	1	50 gpm portable diatomite...	5-55	4-3,000	255	50	3,000	60,000	
Engr w sup team CC.....	1	One distillation unit.....						2,500	
Engr w sup team CD.....	1	One well rig.....							
Engr w sup team CE.....									5 700-gal tankers.
Engr w sup team CF.....									8 1,500-gal semi-trailers.

¹ One pump at purification rate, others at full rated capacity.

² Within each set only one tank is available for storage. The remaining tanks are used in the treatment process.

³ Since a part of the equipment is normally held in reserve, the maximum daily production is not normally attained.

RESTRICTED

RESTRICTED—Security Information

c. Distillation Units.

1	2	3	4	5	6	7	8	9	10	11	12
	Distillate capacity		Economy pounds distilled per lb fuel	Fuel required		Raw water required gph	Mounting	Weight lb	Dimensions		
	Type	gph	gpd ¹	Type	gph				Length	Width	Height
2	Thermo-compression.....	60	1,200	100	Gasoline..	1	130	Skid.....	4,300	7 ft 8 in....	4 ft 6 in... 5 ft.
3	Thermo-compression (Badger).....	150	3,000	150	Gasoline..	1.5	325	Trailer....	4,700	12 ft 7 in....	7 ft 0 in... 6 ft 2 in.
4	Thermo-compression (Cleaver-Brooks).....	150	3,000	150	Gasoline..	1.5	325	Skid.....	6,700	9 ft 6 in....	4 ft 0 in... 6 ft 3 in.
5	Thermo-compression.....	300	6,000	200	Gasoline..	1.5	325	Skid.....	6,800	11 ft 2 in....	4 ft 2 in... 5 ft 6 in.
					Diesel.....	2.0	600	Skid.....	13,600	9 ft ½ in....	5 ft 7 in... 6 ft 4 in.

¹ The distillate capacity in gpd is calculated on the basis of the Corps of Engineers 20-hour day.

d. Water Distribution Equipment.

Equipment	Capacity
Unit kitchen.....	5-gal cans, wt, 50 lbs (filled).
Unit kitchen.....	250-gal water tank trailer.
1-ton trailer.....	40 cans filled.
1½-ton truck.....	60 cans filled.
2½-ton truck.....	100 cans filled.
Water tank truck.....	700 gallons.
Water tank semi-trailer.....	1,500 gallons.

e. Filter Unit Characteristics.

Unit	Type	Output (gpm)	Weight (tons)	Cubage (cu ft)
Knapsack-pack.....	Paper pads.....	¼	7 lb	1
Pack diatomite, No. 2.....	Diatomite.....	15	1.0	130
Portable diatomite, No. 3.....	Diatomite.....	35	1.8	160
No. 4.....	Diatomite.....	50	2.9	270
Stationary diatomite, No. 5.....	Diatomite.....	50	10.5	1,000
No. 6.....	Diatomite.....	200	28	1,800

f. Capacities of Other Water Supply Equipment.

Item	Capacity
Surface pump, centrifugal type 2-inch suction and discharge. ¹	55 gpm against total head of 50 feet including 15-foot suction lift.
Shallow well pump, plunger type, 2½-inch ¹	10 gpm.
Deep well pumps:	
Plunger type, 2½ inch.....	10 gpm.
Turbine type, 6 inch.....	200 gpm against 200-foot head.
Air lift type.....	Variable.
Helical rotor type.....	60 gpm against 250-foot head.
Percussion well-drilling machine.....	4- to 6-inch well, 800 feet.
Rotary well-drilling machine.....	4- to 6-inch well, 1,000 feet.

¹ Larger pumps available in depot stock and in special units.

120. Adjutant General Supplies

	1	2	3	4	5
1	Item	Pounds per man per day	Short tons per 1,000 men per month	Measurement tons per 1,000 men per month	Sacks of mail per 1,000 men per month
	Forms and publications:				
2	Total, forms and publications.....	0.033	0.5	1.0	-----
	Postal:				
3	Letter mail ¹	² .024	.355	³ 1.98	17.8
4	Parcel post ⁴	.249	3.70	³ 16.78	151.0
5	Postal supplies.....	.011	.171	⁵ 0.6	-----
6	Total postal.....	.284	4.23	19.4	-----

¹ 60 percent moved by air during World War II; does not include V-Mail.² Computed at 40 pounds per sack of mail (estimated).³ Computed at 9 sacks per measurement ton (estimated).⁴ Volume may be expected to increase 2.3 times during October and November due to Christmas mail.⁵ Conversion factor 3.5 measurement tons per short ton (estimated).**121. Army Exchange Supplies—Consumption and Replenishment**

	1	2	3	4
1	Item	Pounds per man per day	Short tons per man per month	Measurement tons per man per month
	Combat zone:			
2	Army in amphibious operations ¹	² 0.533	² 0.008	² 0.020
	Theater:			
3	Pacific ³ ⁴	1.571	.024	.050
4	European ⁴	1.428	.021	.043

¹ Based on Operation OLYMPIC estimates, 150-day period.² Does not include sundries pack issued with rations, 0.362 pound per man per day.³ Southwest Pacific Theater planning data, 1945.⁴ Data does not include items procured locally by individual exchanges.⁵ ETO Board Report.**122. Paper Supply**

1	Unit consumer	Consumption tons per day	Maximum production per day	Remarks
2	Radio Broadcast and Leaflet Gp. ¹	2.5	1,000,000	5" x 8" leaflets printed both sides.
3	Radio Broadcast and Leaflet Gp. ¹	2.5	500,000	8½" x 11" news sheets printed both sides.
4	Loudspeaker and Leaflet Co. ²	.7	270,000	5" x 7" leaflets printed both sides.
5	Loudspeaker and Leaflet Co. ²	.7	67,500	10" x 14" news sheets printed both sides.

¹ Based on press equipment authorized by T/A 250-21, 16 Oct. 1950.² Based on press equipment authorized by T/O & E 20-77, 1 Sept. 1950.

Section VII. REQUIREMENTS

123. Day of Supply—Definition

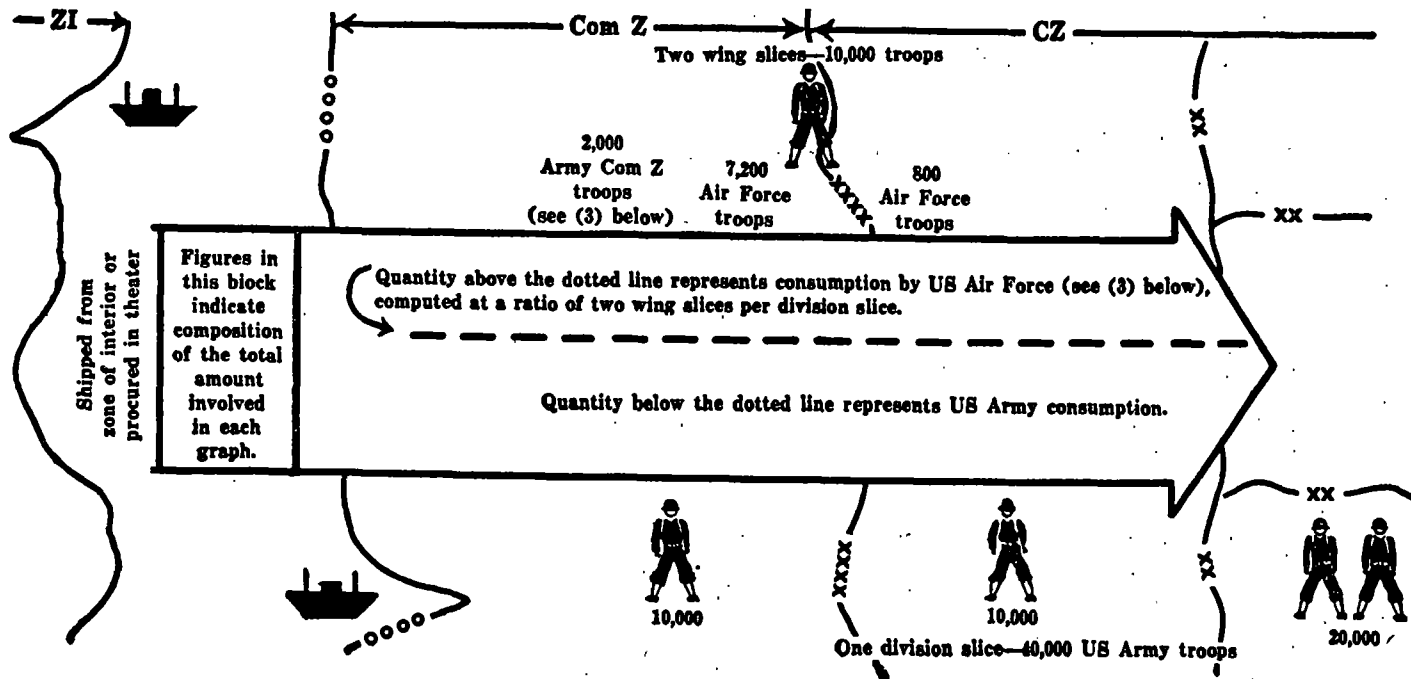
The day of supply, as used in this chapter, is the estimated weight of supplies required to support one man (soldier or officer, air plus ground) in an oversea theater for 1 day based on total strengths and maintenance tonnage experience over a long period of time. These factors are not considered as including initial equipment of troop units, but they do include tonnages for project equipment and similar supplies (other than civilian or other relief supplies) which are required to support troops. The tables shown in paragraphs 125 through 143, supplement the general consumption and flow charts of paragraph 124. They are based on historical data for specific locations, specific types of combat, and specific ground-to-air troop ratios.

124. General Consumption and Flow-Charts

a. Introduction and explanation of graphs.

- (1) This paragraph illustrates, with a series of six graphical charts and supporting tables, the flow of *maintenance supplies* from the zone of the interior or local procurement to consumer groups in the theater of operations.
- (2) The unit of measure, *tons per division slice*, is considered the most appropriate for long-range planning for supply of the Army and Air Force in a theater of operations. The division slice is defined (par. 52) as including "the strength of an average division plus proportionate shares of the total corps, army, communications zone, and theater overhead units." A troop location ratio has been assumed, illustrated by the human figures shown on following chart. Each figure represents 10,000 of the 40,000 men making up the division slice. For illustrative purposes in these charts, it has been assumed that all divisions in the theater are occupying sectors along the front. In practice, varying proportions of these troops will be in reserve, in rest areas, in transit, or staging. Also shown, in a similar fashion, is the proportionate air strength in the theater, based on a ratio of two wing slices (defined in par. 53) per division slice.

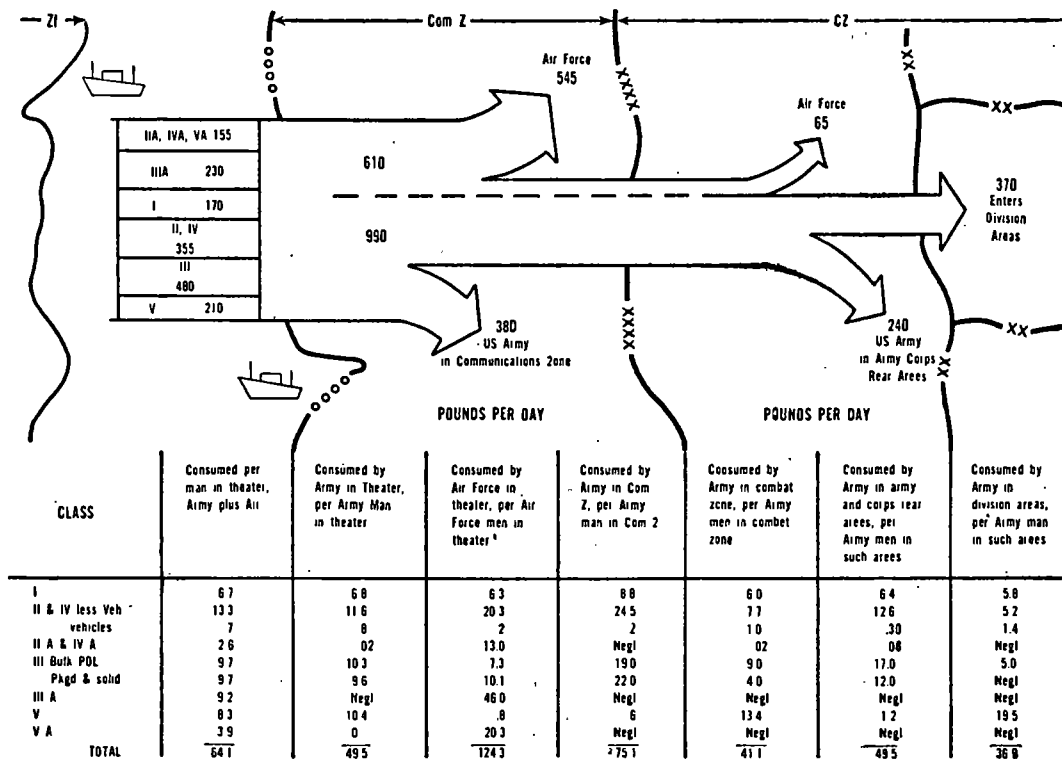
RESTRICTED



RESTRICTED—Security Information

- (3) The graphs include, in addition to the supplies consumed by the Army in the theater, the quantities of supplies brought into the theater for the use of the United States Air Force. All is shown in terms of tons per division slice per day. In all instances, figures based on Air Force strength include those Army troops, part of the wing slice, required within the theater because of the presence of Air Force elements requiring Army administrative support. To separate the quantity of supplies brought into the theater for the Army from those supplies brought in for the Air Force, a horizontal dotted line has been drawn.
- (4) The flow of supplies, in terms of tons per division slice per day, shown in each of the graphs is supported by *pounds per man per day* data displayed beneath each graph. These pounds per man per day figures *approximate* those found in the remainder of the chapter.
- (5) *Procurement in the theater* is indicated in each graph, except for Classes V and VA, as a possible source of supply. The quantity thus available would decrease proportionately the amount to be procured from the zone of interior.
- (6) *Build-up of theater levels* is not included in this series of graphs. However, it can be determined easily by a fractional increase in the amounts shown. For example, if it is desired to establish a theater reserve of 30 days of supply, and accomplish this build-up in 120 days, a fractional increase of 30/120 or $\frac{1}{4}$, can be made in the amounts shown here.

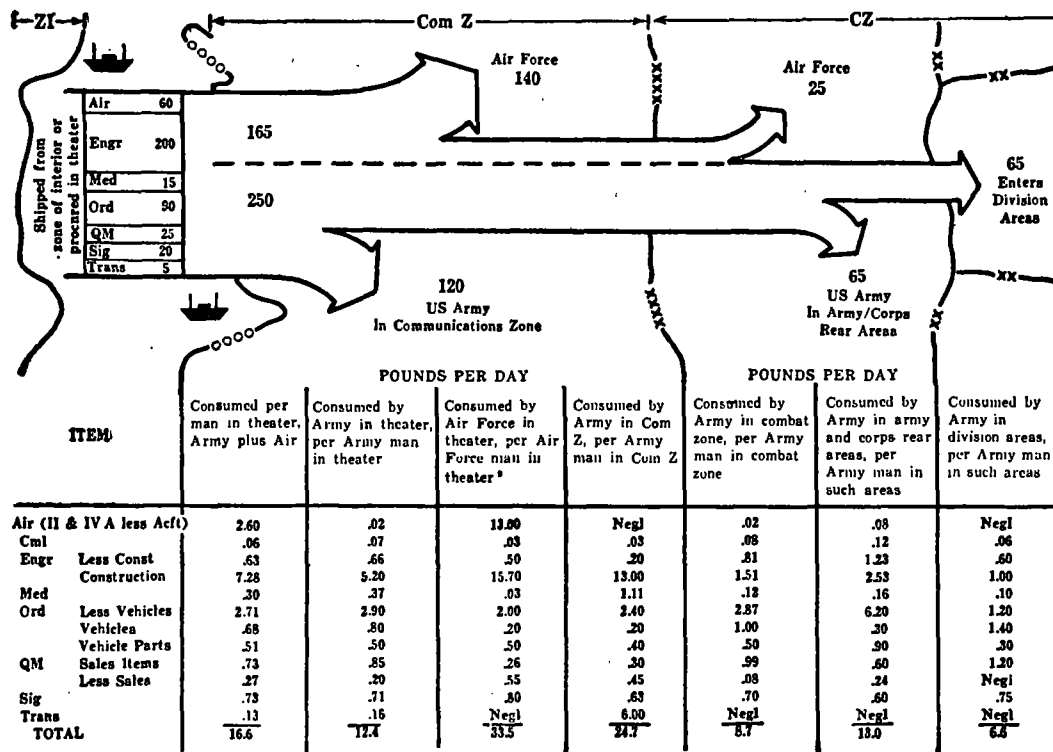
b. Short tons per division slice per day—all classes.



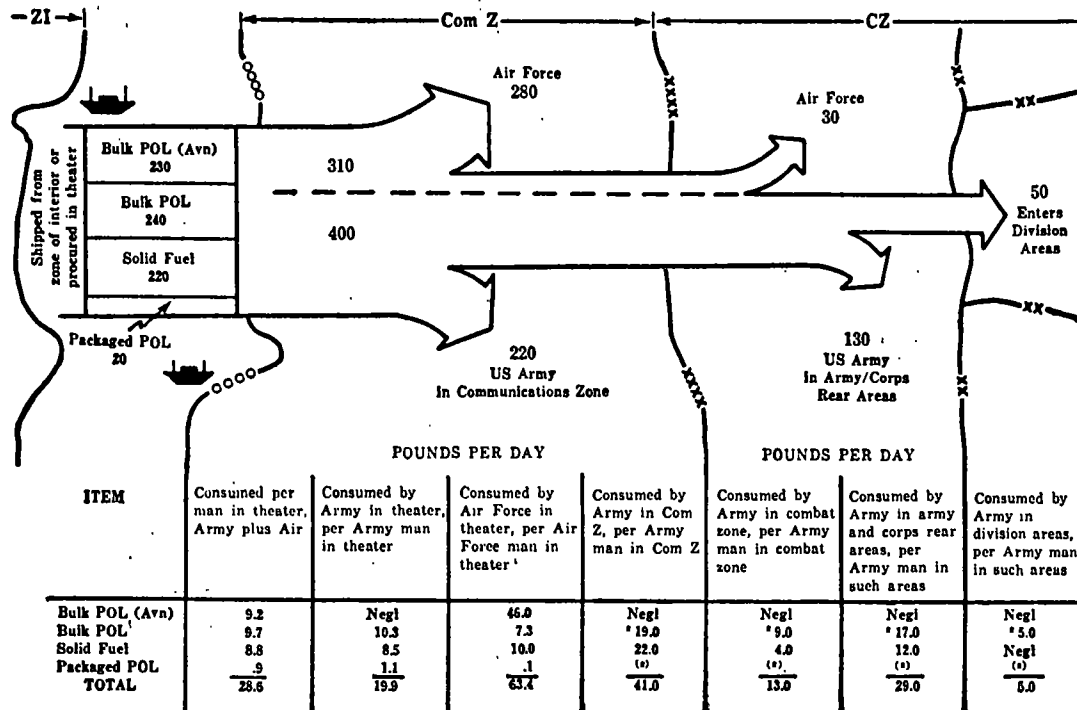
¹ Includes Army troops required within the theater because of the presence of Air Force elements requiring Army administrative support

² This relatively greater figure is due to inclusion in this column of diversions to civilians, prisoners of war, and allies and miscellaneous theater wide losses.

d. Short tons per division slice per day—classes II, IV, IIA, and IVA.

¹ Non-gas conditions.² Includes Army troops required within the theater because of the presence of Air Force elements requiring Army administrative support.

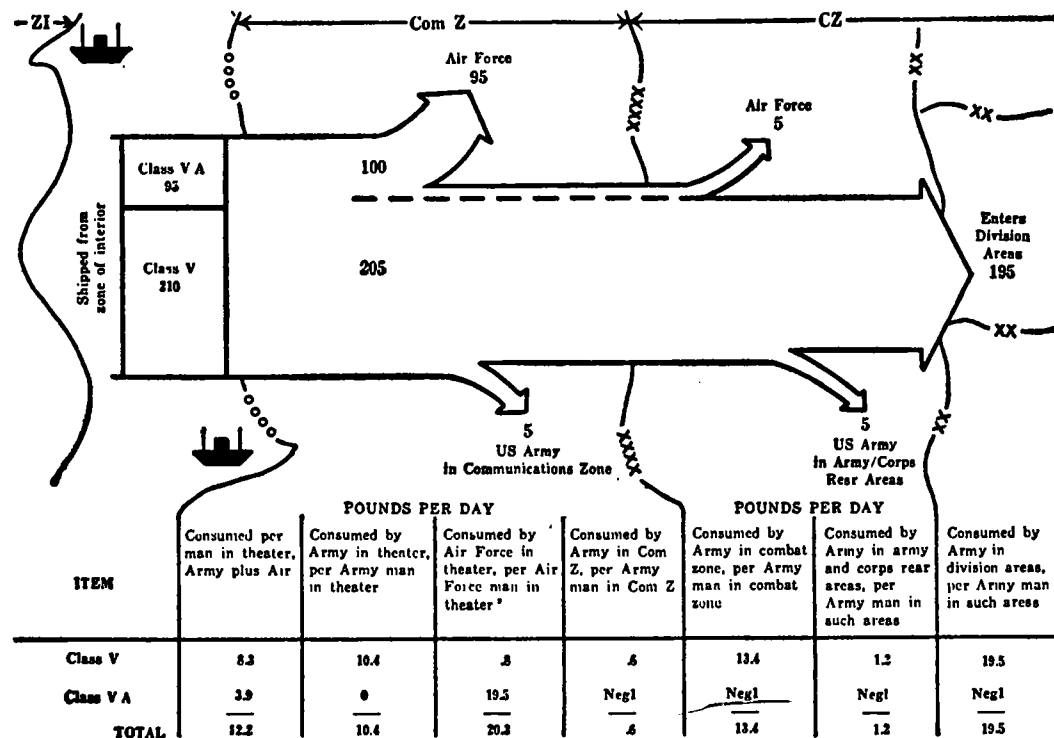
e. Short tons per division slice per day—classes III and IIIA.



¹Includes Army troops required within the theater because of the presence of Air Force elements requiring Army administrative support.

²Due to the variety of means of distribution, bulk and packaged POL can not be segregated in this table.

f. Short tons per division slice per day—classes V and VA.



* Non-gas conditions.

* Includes Army troops required within the theater because of the presence of Air Force elements requiring Army administrative support.

125. European Theater¹

	1	2	3	4	5	6
1	Item	Pounds per man per day	Tons per man per month	Conversion factor short tons to measurement-tons	Measurement tons per man per month	Measurement tons per man per month with 15% stowage
2	Class I—Rations.....	7.170	0.108	2.1	0.227	0.261
3	Class II:					
4	Qm clothing and equipage.....	0.428	0.006	2.0	.012	.014
5	Qm general supplies.....	.305	.005	2.8	.014	.016
6	Ordnance vehicle replacement.....	.620	.009	2.2	.020	.023
7	Engineer.....	.630	.009	3.3	.030	.035
8	Ordnance.....	2.710	.041	1.8	.074	.085
9	Chemical.....	.025	.001	2.3	.002	.002
10	Signal (incl class IV).....	.725	.011	3.8	.042	.048
11	Medical (incl class IV and I).....	.300	.005	2.5	.013	.015
11	Total class II.....	5.740	.087		.207	.238
12	Class III:					
13	Gas, oil, grease ² (less AF).....	11.400	.171	1.5	.257	.296
14	AF fuel and lubricants ³	13.400	.201	1.5	.302	.347
14	Subtotal ⁴	24.800	.372		.559	.643
15	Fuel for temperate zone.....	8.500	.128	2.0	.256	.294
16	Total class III.....	33.300	.500		.815	.937
17	Class IV:					
18	Medical (incl in class II).....					
19	Ordnance motor maintenance.....	.510	.008	1.0	.008	.009
20	Qm sales items.....	2.000	.030	1.7	.051	.059
21	AF supply and replacement.....	2.840	.043	4.0	.172	.198
22	Engineer construction material.....	7.280	.109	1.5	.164	.189
23	Signal (incl in class II).....					
24	Chemical.....	Negligible				
25	Transportation.....	Negligible				
25	Total class IV.....	12.600	.190		.395	.455
26	Class V:					
27	Ammunition (less AF).....	3.640	.055	.9	.050	.058
28	AF ammunition.....	4.410	.066	.9	.059	.068
28	Total class V.....	8.050	.121		.109	.126
29	Total, European Theater.....	66.800	1.010		1.750	2.020

¹ Nongas conditions.² Conversion factors are based on average cuhage for each item. Measurement ton (40 cu ft) of any one item can be found by multiplying its short ton (2,000 lb) weight by that item's conversion factor.³ Consists of the following:

90% gasoline.

4% Diesel fuel.

3% engine oil.

1% gear lubricant.

2% greases.

⁴ Class IIIA.⁵ Assume 90% of quantities shown in this line is shipped by tanker and 10% is shipped in packaged containers as dry cargo.

126. Pacific Theater ¹

	1	2	3	4	5	6
1	Item	Pounds per man per day	Tons per man per month	Conversion factor short tons to measurement-tons ²	Measurement, tons per man per month	Measurement, tons per man per month with 15% stowage
2	Class I—Rations.....	6.710	0.101	2.1	0.212	0.244
	Class II:					
3	Qm clothing and equipage.....	1.000	.015	2.0	.030	.035
4	Qm general supplies.....	.730	.011	2.8	.031	.036
5	Ordnance vehicle replacement.....	.620	.009	2.2	.020	.023
6	Engineer.....	.370	.006	3.3	.020	.023
7	Ordnance.....	.300	.005	1.8	.009	.010
8	Chemical (incl class IV).....	.567	.009	2.3	.021	.024
9	Signal (incl class IV).....	.750	.011	3.8	.042	.048
10	Medical (incl class IV and I).....	.3330	.005	2.5	.013	.015
11	Total class II.....	4.670	.071	-----	.186	.214
	Class III:					
12	Gas, oil, grease ³ (less A F).....	10.800	.162	1.5	.243	.279
13	A F fuel and lubricants ⁴	11.080	.166	1.5	.249	.286
14	Subtotal ⁵	21.900	.328	-----	.492	.565
15	Fuel for temperate zone.....	8.500	.128	2.0	.256	.294
16	Total class III.....	30.400	.456	-----	.748	.859
	Class IV:					
17	Medical (incl in class II).....	-----	-----	-----	-----	-----
18	Ordnance motor maintenance.....	.180	.003	1.0	.003	.003
19	Qm sales items.....	1.970	.030	1.7	.051	.059
20	A F supply and replacement.....	2.840	.043	4.0	.172	.198
21	Engineer construction material.....	11.900	.179	1.5	.268	.308
22	Signal (incl in class II).....	-----	-----	-----	-----	-----
23	Chemical (incl in class II).....	-----	-----	-----	-----	-----
24	Transportation.....	.130	.002	2.4	.005	.006
25	Total class IV.....	17.000	.257	-----	.499	.574
	Class V:					
26	Ammunition (less A F).....	5.140	.077	.9	.070	.081
27	A F ammunition.....	3.470	.052	.9	.047	.054
28	Total class V.....	8.610	.129	-----	.117	.135
29	Total, Pacific Theater.....	67.4	1.010	-----	1.760	2.030

¹ Nongas conditions.² Conversion factors are based on average cubage for each item. Measurement tons (40 cu ft) of any one item can be found by multiplying its short ton (2,000 lb) weight by that item's conversion factor.³ Consists of following:

- 63% gasoline.
- 31% Diesel fuel.
- 3% engine oil.
- 1% gear lubricant.
- 2% greases.

⁴Class IIIA.⁵ Assume 90 percent of quantity shown in this line is shipped by tanker and 10 percent is shipped in packaged containers as dry cargo.

127. Polar Regions¹

1	2	3	4	5	6
Item	Pounds per man per day	Tons per man per month	Conversion factor short tons to measurement tons ²	Measurement, tons per man per month	Measurement, tons per man per month with 15% stowage
Class I—Rations.....	10.40	0.156	2.1	0.328	0.377
Class II:					
Qm clothing and equipage.....	.85	.013	2.9	.038	.044
Qm general supplies.....	.40	.006	2.8	.017	.020
Ordnance vehicle replacement.....	.62	.009	2.2	.020	.023
Engineer.....	.84	.013	3.3	.043	.049
Ordnance.....	2.00	.030	1.8	.054	.062
Chemical (Incl class IV).....	.03	Negligible	2.3	.001	.001
Signal (Incl class IV).....	.66	.010	3.8	.038	.044
Medical (Incl class IV).....	.40	.006	2.5	.015	.017
Total class II.....	5.8	.087		.226	.260
Class III:					
Gas, oil, grease, compounds.....	9.0	.135	1.5	.203	.233
AF fuel and lubricants ³	14.0	.210	1.5	.315	.362
Fuel, solid.....	18.50	.277	2.0	.555	.638
Total class III.....	41.5	.622		1.073	1.233
Class IV:					
Medical (Incl in class II).....					
Ordnance motor maintenance.....	.5	.008	1.0	.008	.009
Qm sales items.....	2.0	.030	1.7	.051	.059
AF supply and replacement ⁴	3.5	.052	4.0	.208	.239
Engineer const. material.....	12.0	.180	1.5	.270	.310
Signal (Incl in class II).....					
Chemical (Incl in class II).....					
Total class IV.....	18.0	.270		.537	.618
Class V:					
Ammunition.....	1.8	.027	0.9	.024	.028
AF ammunition ⁵	3.5	.052	0.9	.047	.054
Total class V.....	5.3	.079		.071	.082
Total.....	81.0	1.22		2.24	2.58

¹ Estimated, based on Arctic test operations.² Conversion factors are based on average cubage for each item. Ship tons (40 cu ft) of any one item can be found by multiplying its short ton (2000 lb) weight by that item's conversion factor.³ Class IIIA.⁴ Classes IIA and IVA.⁵ Class VA.

128. Combat Zone and Communications Zone

	1	2	3	4
1	Item	Pounds per man per day		
		Per army man in combat zone, continental land mass ¹	Per army man in combat zone, jungle ²	Per army man in communica- tions zone ³
2	Class I.....	7.69	5.95	8.80
	Classes II and IV:			
3	Air.....	.023	.016	Negligible
4	Cml.....	.040	.090	.030
5	Eng.....	2.49	8.95	13.2
6	Med.....	.112	.560	1.11
7	Ord.....	4.95	.860	3.00
8	Qm.....	.928	1.35	.75
9	Sig.....	.973	.346	.63
10	Trans.....	Negligible	Negligible	6.00
11	Total II and IV.....	9.52	12.2	24.7
12	Class III.....	12.0	7.53	41.0
13	Class V.....	13.4	8.68	1.40
14	Total.....	42.6	34.4	75.9

¹ Based on operations in Europe, all armies, 24 February 1945 to 28 March 1945.

² Based on Sixth and Eighth Army operations, December 1943 to September 1944.

³ Assumed from theater averages, World War II.

129. Field Army and Corps in Combat

1	1		2	3
	Item		Short tons per day	
			Per field army ¹	Per corps ²
2	Class I.....		1420	346
3	Classes II and IV:			
4	Air.....		133	Negligible
5	Cml.....		7.4	1.8
6	Engr.....		461	112
7	Med.....		20.7	5
8	Ord.....		916	223
9	Qm.....		172	41.8
10	Sig.....		180	43.8
11	Total II and IV.....		1,760	427
12	Class III.....		2,220	540
13	Class V ³		3,200	800
	Total.....		8,600	2,113

¹ Computed for field army of 3 corps, each corps composed of 3 infantry and 1 armored division, and including necessary supporting and service elements.

² Computed for corps of 3 infantry divisions and 1 armored division, with necessary supporting and service elements.

³ Class V data applicable for periods of 14 days or more.

130. Airborne Division in Airborne Assault ¹

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	6.60	58
3	Classes II and IV:		
4	Cml.....	0	0
5	Engr.....	1.00	9
6	Med.....	.42	3
7	Ord.....	0	
8	Qm.....	0	
9	Sig.....	1.04	9
9	Total II and IV.....	2.46	21
10	Class III.....	1.70	15
11	Class V:		
12	Cml.....	.20	2
13	Ord.....	41.0	308
13	Total V.....	41.2	310
14	Total.....	52.0	404

¹ Nongas conditions.**131. Armored Division in Attack ¹**

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.37	43
3	Classes II and IV:		
4	Cml.....	.25	2
5	Engr.....	.70	6
6	Med.....	.30	2
7	Ord.....	*14.10	*113
8	Qm.....	2.11	17
9	Sig.....	0.87	7
9	Total II and IV.....	18.30	147
10	Class III.....	13.80	111
11	Class V.....	50.0	401
12	Total.....	87.5	702

¹ Nongas conditions.

* Primarily battle losses of combat vehicles.

132. Armored Division in Pursuit and Exploitation ¹

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
1			
2	Class I.....	5.61	45
3	Classes II and IV:		
4	Cml.....	.25	2
5	Engr.....	.54	4
6	Med.....	.30	2
7	Ord.....	2.14	17
8	Qm.....	2.11	17
9	Sig.....	.85	6
10	Total II and IV.....	6.19	49
11	Class III.....	23.30	187
12	Class V.....	8.8	70
	Total.....	43.9	351

¹ Nongas conditions.

133. Armored Division in Defense ¹

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
1			
2	Class I.....	5.51	44
3	Classes II and IV:		
4	Cml.....	.25	2
5	Engr.....	.42	3
6	Med.....	.15	1
7	Ord.....	2.00	17
8	Qm.....	2.11	17
9	Sig.....	.37	3
10	Total II and IV.....	5.30	43
11	Class III.....	7.51	60
12	Class V.....	53.2	422
	Total.....	71.5	569

¹ Nongas conditions.

134. Armored Division in Reserve ¹

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.51	44
	Classes II and IV:		
3	Cml.....	.25	2
4	Engr.....	.21	2
5	Med.....	.15	1
6	Ord ²	2.50	20
7	Qm ³	2.25	18
8	Sig.....	.37	3
9	Total II and IV.....	5.73	46
10	Class III.....	5.83	46
11	Total V ³		
12	Total.....	17.3	136

¹ Nongas conditions.² Increase over inactive situation due to intensified maintenance and replacement activities.³ All elements of division out of combat.**135. Infantry Division in Attack of Fortified Position ¹**

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.72	54
	Classes II and IV:		
3	Cml.....	.251	2
4	Engr.....	2.13	20
5	Med.....	.301	3
6	Ord.....	1.67	16
7	Qm.....	.942	9
8	Sig.....	.959	9
9	Total II and IV.....	6.25	59
10	Class III.....	4.03	46
11	Class V.....	47.8	451
12	Total.....	64.7	610

¹ Nongas conditions.

136. Infantry Division in Attack of Deliberately Organized Position ¹

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.37	51
	Classes II and IV:		
3	Cml.....	.252	2
4	Engr.....	.843	8
5	Med.....	.301	3
6	Ord.....	1.67	16
7	Qm.....	.929	8
8	Sig.....	.991	9
9	Total II and IV.....	4.98	46
10	Class III.....	7.92	74
11	Class V.....	44.4	418
12	Total.....	62.7	589

¹ Nongas conditions.

137. Infantry Division in Attack of Hastily Organized Position ¹

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.46	51
	Classes II and IV:		
3	Cml.....	.051	0.5
4	Engr.....	1.26	12
5	Med.....	.125	1
6	Ord.....	2.83	25
7	Qm.....	.938	8
8	Sig.....	.961	9
9	Total II and IV.....	6.16	56
10	Class III.....	8.47	80
11	Class V.....	42.8	403
12	Total.....	62.9	590

¹ Nongas conditions.

138. Infantry Division in Covering, Security Force, Retirement, or Delaying Action ¹

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.42	51
	Classes II and IV:		
3	Cml.....	.361	3
4	Engr.....	.811	7
5	Med.....	.121	1
6	Ord.....	1.47	14
7	Qm.....	1.32	13
8	Sig.....	.721	6
9	Total II and IV.....	4.80	45
10	Class III.....	12.5	118
11	Class V.....	26.1	246
12	Total.....	48.8	460

¹ Nongas conditions.**139. Infantry Division in Pursuit ¹**

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.61	53
	Class II and IV:		
3	Cml.....	.091	1
4	Engr.....	.979	9
5	Med.....	.111	1
6	Ord.....	2.08	20
7	Qm.....	.659	6
8	Sig.....	.710	7
9	Total II and IV.....	4.63	44
10	Class III.....	15.3	144
11	Class V.....	7.7	73
12	Total.....	33.2	314

¹ Nongas conditions.

140. Infantry Division in Assault of Hostile Shore ¹

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
1			
2	Class I.....	6.19	58
	Classes II and IV:		
3	Cml.....	.191	2
4	Engr.....	1.17	10
5	Med.....	.221	2
6	Ord.....	.769	7
7	Qm.....	.502	5
8	Slg.....	.389	3
9	Total II and IV.....	3.24	29
10	Class III.....	4.56	43
11	Class V.....	43.3	409
12	Total.....	57.3	539

¹ Nongas conditions.

141. Infantry Division in Defense of Position ¹

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
1			
2	Class I.....	5.51	52
	Class II and IV:		
3	Cml.....	.361	3
4	Engr.....	1.46	14
5	Med.....	.221	2
6	Ord.....	1.50	14
7	Qm.....	1.10	10
8	Slg.....	.989	9
9	Total II and IV.....	5.63	52
10	Class III.....	6.83	64
11	Class V.....	50.0	472
12	Total.....	70.0	640

¹ Nongas conditions.

142. Infantry Division in Inactive Situation ¹

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.19	49
	Class II and IV:		
3	Cml.....	.251	2
4	Engr.....	.501	4
5	Med.....	.151	1
6	Ord.....	.829	8
7	Qm.....	2.11	20
8	Sig.....	.479	4
9	Total II and IV.....	4.32	39
10	Class III.....	6.41	60
11	Class V ²	16.2	153
12	Total.....	32.1	301

¹ Nongas conditions.² All elements out of combat.**143. Infantry Division in Reserve ¹**

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.38	51
	Classes II and IV:		
3	Cml.....	.251	2
4	Engr.....	.159	1
5	Med.....	.151	1
6	Ord.....	1.25	11
7	Qm.....	2.11	20
8	Sig.....	.479	4
9	Total II and IV.....	4.40	39
10	Class III.....	2.23	21
11	Class V ²		
12	Total.....	12.0	111

¹ Nongas conditions.² All elements out of combat.

RESTRICTED—Security Information

144. Day of Follow-Up (Unit) Air Supply a. Airborne Division.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Item	Unit	Pack A abn inf bn	Pack B abn inf regt ¹	Pack C abn fa bn	Pack D abn fa-aw hn	Pack E abn enrg hn	Pack F abn enrg co	Pack G abn sep units ²	Pack H abn div ³	Pack I hv tk bn	Pack J 155-mm how bn	Pack K ren co	Pack L medium maint ord co qm fld sv co
2	CHEMICAL		Quantity wt .44	Quantity wt 1.32	Quantity wt	Quantity wt	Quantity wt .15	Quantity wt .05	Quantity wt .09	Quantity wt 4.20	Quantity wt	Quantity wt	Quantity wt	Quantity wt
3	Grenade:													
4	Hand, smoke WPM 15.....	Each.....	300	900			90	30	30	3,000				
5	Incendiary, AN M-14.....	Each.....	10	30			9	3	21	120				
6	Hand, smoke, colored M-18.....	Each.....	40	120			21	7	19	400				
7	Mask, gas, lightweight.....	Each.....	10	30	10	10	9	3	21	150				
8	MEDICAL			1.10					.40	3.70				
9	Acetylsalicylic acid tablets, 0.324 gm. (5 gr.) 1000's.....	Bottle.....		1						3				
10	Alcohol, 5 gal: USP; Ethanol; Ethyl alcohol.....	Can.....		1						3				
11	Ether, anesthesia, ¼ lb.....	Can.....		10					10	40				
12	Pentothal sodium ampules, 0.5 gm (7½ gr.) 25's.....	Box.....		1						3				
13	Sodium citrate solution anticoagulant ampules 4 percent 50cc 6's.....	Box.....		2					2	8				
14	Sulfadiazine tablets, 0.5 gm. (7½ gr.) 1000's.....	Bottle.....		1					2	5				
15	Water for injection, 50cc. 25's.....	Box.....		8					1	25				
16	Whisky, 4/5 qt: medicinal.....	Bottle.....		3					1	10				
17	Gosganerene antitoxin, trivalent, Type 2.....	Bottle.....		6						18				
18	Albumin, serum, human, 25 gm. 100cc.....	Can.....		6						18				
19	Penicillin, crystalline, 200,000 units.....	Bottle.....		20					10	70				
20	Plasma, normal, human, dried, 500 cc.....	Package.....		150					50	500				
21	Tetanus toxoid, plain, 30 cc.....	Bottle.....		5						15				
22	Bandage, gauze, roller, 3 inches by 10 yards, 12's.....	Package.....		0					7	25				
23	Cotton, absorbent, 1 lb.....	Roll.....		2					2	8				
24	Plaster, adhesive, surgical, camouflaged, 1 inch by 5 yards.....	Spool.....		10					5	35				
25	Plaster, adhesive, surgical, 3 inches by 5 yards.....	Spool.....		10					5	35				
26	Wadding, sheet, cotton, 5 inches by 6 yards, 12's.....	Package.....							8	8				
27	Splint, leg and thigh, half ring, folding: Army.....	Each.....		30					35	125				
28	Towels, hand.....	Each.....		10					6	36				
29	Nitrous oxide, filled Type D cylinder, 250 gal.....	Each.....		3						3				
30	Oxygen, filled type G cylinder, 1,500 gal.....	Each.....		1					2	6				
31	Morphine tartrate syrettes, 0.324 gm. (½ gr.) 5's.....	Package.....		20					15	75				
32	Bandage, Plaster of Paris, 0 inches by 5 yards, 12's.....	Package.....		3					6	15				
33	Bandages, muslin triangular, compressed camouflaged, 37 by 52 inches.....	Each.....		15					15	60				
34	Dressing, first aid, camouflaged, large.....	Each.....		20					15	75				
35	Dressing, first aid, camouflaged, small.....	Each.....		80					60	300				
36	Boric acid ointment, ½ oz. 2's.....	Package.....		10					18	48				
37	Iodine swab 10 minim, 10 s.....	Package.....		50					30	180				
38	Sponge, surgical, 4x4, 500's.....	Package.....		8					16	40				
39	Pack, abdominal, 12 by 15 inches, 80's.....	Package.....		1						3				
40	Splint set, airplane crash.....	Set.....		1					2	5				
41	Blanket, wool, olive-drab.....	Each.....		300					100	1,000				
42	Litter, folding, aluminum pola.....	Each.....		30					35	125				
43	Pad, heat, chemical.....	Each.....		3					3	12				
44	QUARTERMASTER		3.40	13.50	2.90	2.00	2.70	.50	11.30	65.70	7.00	7.20	2.25	2.00
45	Rations: individual combat.....	Each.....	900	3,300	550	420	700	170	3,000	15,070	700	800	200	350
46	Gasoline MT 80.....	Gallons.....	100	600	250	150	100		300	3,100	1,000	600	200	100
47	Oil No. 30.....	Gallons.....	5	30	15	10	5		15	165	100	50	20	10
48	Halazone tablets.....	Bottles.....	10	40	5	5	10		35	185				
49	Rations: Special Items pack, hosp.....	Each.....		75					100	250				
50	ENGINEER			.05			.75			.90				
51	Wire, barbed, 100-lb coil.....	Coils.....		1			15			18				
52	ORDNANCE		14.70	51.20	32.80	7.50	8.85	2.60	13.50	282.00	118.00	104.00	8.40	
53	Cal. 30 AP:													
54	8 clip M-1.....	Rounds.....	13,000	40,000			12,000	4,000	4,000	130,000				
55	5 clip BAR.....	Rounds.....	1,500	4,500					200	13,700				
56	Belted tracer (4-1).....	Rounds.....	20,000	60,000			30,000	10,000		210,000				
57	Carbina.....	Rounds.....	14,700	44,000	25,000	20,000	4,500	1,500	5,000	256,000				
58	Tracer clip or cartridge.....	Rounds.....	3,000	9,000			1,000	350	500	28,500				
59	Cal. 30 ball:													
60	8 clip.....	Rounds.....	15,000	45,000			18,000	6,000	4,000	157,000				
61	5 clip BAR.....	Rounds.....	1,500	4,500					200	137,200				
62	Belted ball tracer 4-1.....	Rounds.....	13,000	40,000			21,000	7,000		141,000				
63	Col. .45 ball.....	Rounds.....	1,500	4,000	23,000	20,000	12,000	4,000	500	113,500				
64	Cal. .50 AP-T, 2-2-1.....	Rounds.....	8,000	24,000	40,000	4,000	12,000	4,000	30,000	238,000				
65	60-mm mortar:													
66	HE.....	Rounds.....	2,500	7,500						22,500				
67	Illumination.....	Rounds.....	200	600						1,800				
68	81-mm mortar:													
69	HE (Lt).....	Rounds.....	70	210						630				
70	HE (Hv).....	Rounds.....	20	60						180				
71	WP (Smoke).....	Rounds.....	10	30						90				
72	40 mm aaa gun:													
73	HE.....	Rounds.....				4,500				4,500				
74	AP.....	Rounds.....				300				300				
75	90-mm gun AT:													
76	HE.....	Rounds.....		200					100	700				
77	AP.....	Rounds.....		20					10	40				
78	105-mm how:													
79	HE W/F M-48.....	Rounds.....			500					1,500				
80	HE W/F M-54.....	Rounds.....			300					900				
81	WP.....	Rounds.....			110					300				
82	HE AT.....	Rounds.....			55					105				
83	155-mm how:													
84	HE w/charge.....	Rounds.....										1,600		
85	WP w/charge.....	Rounds.....										200		
86	Rifle:													
87	57-mm M-18 (recoilless).....	Rounds.....	270	810						2,430				
88	75-mm M-20 (recoilless).....	Rounds.....	55	160					40	520				
89	Rocket:													
90	HE AT, 2.36 in.....	Rounds.....	90	270					20	830				
91	3.5-in.....	Rounds.....	70	210	140	60	100	30	90	1,300				
92	Grenade:													
93	Hand fragmentation.....	Rounds.....	300	900			300	100	100	3,100				
94	Rifle, AT.....	Rounds.....	200	600			200	70		2,000				
95	Rifle, smoke.....	Rounds.....	100	300			100	30		1,000				
96	4.2-in mortar:													
97	Smoke (WP).....	Rounds.....	7	20					40	100				
98	HE M-3, WM-3 Fuse.....	Rounds.....	35	100					100	400				
99	Mines:													
100	Antipersonnel.....	Each.....	5	15			15			60				
101	Antitank.....	Each.....	40	120			140			500				
102	Bangalore torpedoes.....	Each.....	2	10			20			50				
103	Tank:													
104	1 M-24 (75 mm-gun).....	Rounds.....									200		700	
105	m, M-20 (90-mm gun).....	Rounds.....									3,150			
106	m, M-45 (105-mm how).....	Rounds.....									600			
107	Cop, blasting, speciol:													
108	Nonelectric.....	Each.....	10	30			60			150				
109	Electric.....	Each.....	10	30			60			150				
110	Cord, detonating, 100-ft roll.....	Rolls.....	1	3			1			10				
111	Block, demolition, M-3 or M-4.....	Lb.....	300	900			1,100			2,000				
112	Firing device:													
113	Pull type M-1.....	Each.....	2	6			7			25				
114	Pressure type M-3.....	Each.....	2	6			7			25				
115	Pressure release.....	Each.....	1	3			1			10				
116	Fuse:													
117	Blasting, time, 100-ft roll.....	Rolls.....	1	3			1			10				
118	Lighters, pull type.....	Each.....	20	60			20			200				
119	TNT or equivalent (50-lb boxes).....	Boxes.....	2	6			2			20				
120	SIGNAL		.60	1.80	.50	.50	.50		2.30	9.20				
121	Battery:													
122	BA-2.....	Each.....							20	20				
123	BA-23.....	Each.....							5	5				
124	BA-27.....	Each.....							15	15				
125	BA-30.....	Each.....	50	150	40	40	20		100	730				
126	BA-270/U.....	Each.....	25	75					100	325				
127	BA-43.....	Each.....	5	15	5	5	5		10	80				
128	BA-48.....	Each.....							50	50				
129	BA 279/U.....	Each.....	10	30	10	10	10		10	60				
130	Flashlight, TL-122A.....	Each.....	5	15	5	5	5		10	80				
131	Rodlo:													

b. Armored Division.

	1	2	3	4	5	6	7
1	Item	Unit	Pack N for one armored combat command ¹		Pack O for armored division ²	Pack P ³	
			Quantity	Weight ⁴	Weight ⁴	Quantity	Weight ⁴
2	CHEMICAL.....			0.370	1.120		
	Grenades:						
3	Smoke, M15.....	Each.....	75				
4	Smoke, colored, assorted colors, M18.....	Each.....	75				
5	Incendiary, AN-M14.....	Each.....	75				
6	Mask, protective, field.....	Each.....	36				
7	MEDICAL.....			0.370	4.334		
8	Ether, anesthesia, ¼-lb.....	Can.....	48				
9	Pentothal sodium ampules, 1.0 gm. (15-gr) 25's.....	Box.....	3				
10	Sulfadiazone tablets, 0.5 gm (7½-gr) 100's: USP.....	Bottles....	3				
11	Water for injection, 50cc, 25's.....	Box.....	6				
12	Penicillin, crystalline, 200,000 units.....	Bottle.....	336				
13	Plasma, normal human dried, 500cc.....	Package....	180				
14	Tetanus toxoid, plain, 30cc.....	Bottle.....	6				
15	Bandage, gauze, roller, 3 inches x 10 yards, 12's.....	Package....	36				
16	Plaster, adhesive, surgical, camou- flaged, 1 inch x 5 yards.....	Spool.....	90				
17	Splint, leg and thigh, half ring, folding: Army.....	Each.....	15				
18	Boric acid ointment, ¼ oz., 2's.....	Package....	12				
19	Iodine swab, 10 minim, 10's.....	Package....	36				
20	Morphine tartrate syrettes, 0.032 gm (¼ gr) 5's.....	Package....	36				
21	Bandage, muslin, triangular, com- pressed, camouflaged, 37 x 37 x 52 inches.....	Each.....	36				
22	Dressing, first aid, camouflaged, large.....	Each.....	210				
23	Dressing, first aid, camouflaged, small.....	Each.....	300				
24	Blanket set, large.....	Each.....	3				
25	Litter, straight, aluminum pole.....	Each.....	30				
26	QUARTERMASTER.....			23.631	83.486		12.593
27	Rations, 40% combat and 60% assault.....	Each.....	3,300			3,100	
28	Gasoline, MT 80.....	Gallons....	4,200			1,400	
29	Oil No. 30.....	Gallons....	105			85	
30	No. 50.....	Gallons....	105			85	
31	Halazone tablets.....	Bottles....	45			15	
32	ORDNANCE.....			131.000	240.000		11.536
33	60-mm mortar, HE.....	Rounds....	293			147	
	81-mm mortar:						
34	HE (light).....	Rounds....	848			160	
35	HE (heavy).....	Rounds....	169			33	
36	WP.....	Rounds....	23			3	
	105-mm howitzer, M2-M4:						
37	HE W/FM 48.....	Rounds....	1,320				
38	HE W/FM 54.....	Rounds....	440				
39	WP.....	Rounds....	100				

See footnotes at end of table.

b. Armored Division—Continued

1	1	2	3	4	5	6	7
	Item	Unit	Pack N for one armored combat command 1		Pack O for armored division 2	Pack P 3	
			Quantity	Weight 4	Weight 4	Quantity	Weight 4
	105-mm howitzer, M2-M4—Con.						
40	HE AT.....	Rounds.....	140				
41	155-mm howitzer, HE.....	Rounds.....	90			180	
	75-mm gun:						
42	HE s/c w/FM 48.....	Rounds.....	1,920				
43	WP.....	Rounds.....	520				
44	APC.....	Rounds.....	960				
45	76-mm gun, tank: HE.....	Rounds.....	113				
46	76-mm gun, tank: APC.....	Rounds.....	29				
	90-mm tank:						
47	HE.....	Rounds.....	25				
48	APC.....	Rounds.....	7				
	40-mm antiaircraft:						
49	HE.....	Rounds.....	5			5	
50	APC.....	Rounds.....	1			1	
	Cal. 30:						
51	AP; 8-clip M1.....	Rounds.....	57,722			24,646	
52	AP-Tr (4-1).....	Rounds.....	103,681			42,457	
53	Carbine.....	Rounds.....	37,823			44,687	
54	Cal. 45 ball (submachine gun).....	Rounds.....	102,816			64,182	
55	Cal. 50 AP-I-T.....	Rounds.....	17,109			8,214	
56	Rocket, HE AT, 2.36 in.....	Rounds.....	222			127	
57	Grenade, rifle, HE AT.....	Rounds.....	136			69	
58	Mine, AT, HE.....	Rounds.....	101			51	
59	Grenado, fragmentation.....	Rounds.....	202			101	
60	TNT or equivalent.....	Pounds.....	600				
61	Cord detonating, 100-ft roll.....	Rolls.....	6				
62	Fuse, blasting, time, 100-ft roll.....	Rolls.....	3				
63	Cap, blasting, nonelectric.....	Each.....	300				
64	Lighter, fuse.....	Each.....	300				
65	Mine, antipersonnel, M3.....	Each.....	54				
	Firing device:						
66	Pull type.....	Each.....	90				
67	Release type.....	Each.....	60				
68	SIGNAL.....			1.422	4.536		0.269
69	Flashlight, TL-122.....	Each.....	30			30	
	Radio set:						
70	AN/PRC-8.....	Each.....	1			2	
71	AN/PRC-6.....	Each.....	2			4	
72	Reel equipment CE-11.....	Each.....	1				
73	Switchboard SB-22 ()/PT.....	Each.....	1				
74	Telephone EE-8.....	Each.....	10				
75	Tool equipment TE-33.....	Each.....	10				
	Wire:						
76	WD-1 ()/TT on DR-5.....	Miles.....	10				
77	WD-1 ()/TT in NX-306/G.....	Miles.....	8				
	Battery:						
78	BA-30.....	Each.....	200			50	
79	BA-270/U.....	Each.....	40				
80	BA-279/U.....	Each.....	21			5	
81	BA-42.....	Each.....	30			10	

See footnotes at end of table.

RESTRICTED—Security Information*b. Armored Division—Continued*

	1	2	3	4	5	6	7
1	Item	Unit	Pack N for one armored combat command ¹		Pack O for armored division ²	Pack P ³	
			Quantity	Weight ⁴	Weight ⁴	Quantity	Weight ⁴
	Mast section:						
82	MS-49	Each	10	.....	.....	4	.....
83	MS-50	Each	10	.....	.....	4	.....
84	MS-51	Each	10	.....	.....	4	.....
85	MS-52	Each	10	.....	.....	4	.....
86	MS-53	Each	10	.....	.....	4	.....
	Tape:						
87	TL-83	Rolls	8	.....	.....	10	.....
88	TL-192	Rolls	8	.....	.....	10	.....
89	Total .....	.....	.....	163.000	411.000	.....	24.398

¹ Based on the assumption that the combat command will consist of the following:

- 1 armored infantry battalion.
- 1 heavy tank company.
- 1 medium tank battalion.
- 1 armored artillery battalion.
- 1 armored engineer company.
- 1 reconnaissance company.
- 1 AAA-AW battery.
- 1 medical company.
- 1 ordnance maintenance company.
- 1/3 signal company.

² Consists of three packs N's and one pack P.

³ For one reconnaissance company headquarters and service elements, armored division.

⁴ Tables give net weight of supplies in short tons. To estimate lift requirements for parachute delivery, assume each bundle will deliver an average of 250 pounds net supply and calculate on basis of number of bundles a given airplane can deliver.

RESTRICTED—Security Information

c. Infantry Division.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Item	Unit	Pack R ¹ for infantry battalion combat team	Pack S ² for infantry regimental combat team	Pack T for infantry battalion		Pack U ³		Pack V ⁴		Pack W for field artillery battalion 105-mm howitzer		Pack X ⁵ for infantry division	Pack Y for field artillery battalion, 155-mm howitzer		Pack Z ⁶	
			Weight ⁷	Weight ⁷	Quantity	Weight ⁷	Quantity	Weight ⁷	Quantity	Weight ⁷	Quantity	Weight ⁷	Weight ⁷	Quantity	Weight ⁷	Quantity	Weight ⁷
2	CHEMICAL.....		0.123	0.369		0.123							1.107				
3	Grenades; smoke M15.....	Each.....			25												
4	Smoke, colored, assorted colors M18.....	Each.....			25												
5	Incendiary, AN-M14.....	Each.....			25												
6	Mask, protective field.....	Each.....			12												
7	MEDICAL.....		0.482	1.445		0.482							4.334				
8	Ether, anesthesia, ¼ lb.....	Can.....			16												
9	Pentothal sodium ampules, 1.0 gm. (15 gr) 25's.....	Box.....			1												
10	Sulfadiazine tablets, 0.5 gm., (7½ gr) 1000's: USP.....	Bottle.....			1												
11	Water for Injection 50cc., 25's.....	Box.....			2												
12	Penicillin, crystalline, 200,000 units.....	Bottle.....			112												
13	Plasma, normal, human, dried, 500cc.....	Package.....			60												
14	Tetanus toxoid, plain, 30cc.....	Bottle.....			2												
15	Bandage, gauze, roller, 3 inches x 10 yards, 12's.....	Package.....			12												
16	Plaster, adhesive, surgical, camou- flaged, 1 inch x 5 yards.....	Spool.....			30												
17	Splint, leg and thigh, half ring, folding; Army.....	Each.....			5												
18	Boric acid ointment ¼ oz., 2's.....	Package.....			8												
19	Iodine swab, 10 minim, 10's.....	Package.....			20												
20	Morphine tartrate syrettes, 0.032 gm (1½ gr) 5's.....	Package.....			12												
21	Bandage, muslin, triangular, com- pressed, camouflaged, 37 x 37 x 52 inches.....	Each.....			12												
22	Dressing, first aid, camouflaged, large.....	Each.....			70												
22	Dressing, first aid, camouflaged, small.....	Each.....			100												
24	Blanket set, large.....	Each.....			1												
25	Litter, straight, aluminum pole.....	Each.....			10												
26	QUARTERMASTER.....		2.914	12.795		2.295		0.619		4.330		1.580	55.912		2.113		15.414
27	Rations, 40 percent combat and 60 percent assault.....	Each.....			892		168		1,274		550			600		2,900	
28	Gasoline, MT 80.....	Gallons.....			100		60		400		100			200		2,200	
29	Oil No. 30.....	Gallons.....			5		5		10		5			10		100	
30	Halazone tablets.....	Bottles.....			10						10			10		20	
31	ENGINEER.....							100		300			3.326				
32	Wire, barbed, 100-lb coil.....	Coils.....					2		6				30.0	300.0		70.0	20.048
33	ORDNANCE.....		11.490	63.178		7.134		4.526		23.769							
34	60-mm mortar, HE.....	Rounds.....			162											162	
	81-mm mortar:																
35	HE (light).....	Rounds.....			352				117							352	
36	HE (heavy).....	Rounds.....			70				24							70	
37	WP.....	Rounds.....			9				3							0	
38	4.2 in mortar.....								120								
39	HE WP.....								50								
40	57-mm rifle.....				70												
41	HE AP.....				30												
42	75-mm rifle.....				20												
43	HE AP.....				20												
	105-mm howitzer M3:																
44	HE.....	Rounds.....							125								
45	WP.....	Rounds.....							7								
46	HE AT.....	Rounds.....							10								
	105-mm howitzer M2-M4:																
47	HE W/FM 48.....	Rounds.....							20		600					35	
48	HE W/FM 54.....	Rounds.....							8		200					117	
49	WP.....	Rounds.....							1		50					3	
50	HE AT.....	Rounds.....							1		35					3	
	90-mm gun:																
51	HE.....	Rounds.....					100		100								
52	APC.....	Rounds.....					36		100								
	155-mm howitzer:																
53	HE.....	Rounds.....												900			
54	WP.....	Rounds.....												70			
55	Charge (90 percent M4, 10 percent, M3).....	Rounds.....												1,000			
56	Fuse (80 percent M51A3, 15 percent M55, 5 percent M07).....	Rounds.....													1,000		
57	Primers.....	Rounds.....													1,000		
	40-mm antiaircraft:																
58	HE.....	Rounds.....							6							6	
59	APC.....	Rounds.....							1							1	
	Cal. 30 AP:																
60	8/clip M1.....	Rounds.....			32,947		3,771		36,962							40,430	
61	5/clip BAR.....	Rounds.....			8,668												
62	AP-Tr (4-1).....	Rounds.....			9,105		5,917		32,322							55,990	
63	Carbino.....	Rounds.....			6,652		972		9,114		13,001			13,276		39,766	
64	Cal. 45 ball (submachine gun).....	Rounds.....			5,323		6,655		31,940		799			799		77,767	
65	Cal. 50 AP-I-T.....	Rounds.....			996		1,494		10,125		3,486			3,486		14,245	
66	Rocket, HE AT, 3.5 in.....	Rounds.....			50		22		150		110			110		250	
67	Grenade, rifle, HE AT.....	Rounds.....			84		11		48		23			6		143	
68	Mine, AT HE.....	Rounds.....			30				10							92	
69	Grenade, fragmentation.....	Rounds.....			65				30							108	
70	TNT or equivalent.....	Pounds.....					200		600								
71	Cord, detonating, 100 ft roll.....	Rolls.....					2		6								
72	Fuse, blasting, time 100-ft roll.....	Rolls.....					1		3								
73	Cap, blasting, nonelectric.....	Each.....					100		300								
74	Lighter, fuse.....	Each.....					100		300								
75	Mine, antipersonnel M3.....	Each.....					24		72								
	Firing device:																
76	Pull type.....	Each.....					30		90								
77	Release type.....	Each.....					20		60								
78	SIGNAL.....		0.784	2,101		0.201		0.583		1.041		0.515	8.657		0.862		1.310
79	Flashlight TL-122.....	Each.....			5		5		15		15			15		30	
	Radio set:																
80	AN/GRC 9.....	Each.....					1		1								
81	AN/PRC-10.....	Each.....					2		2							2	
82	AN/PRC-6.....	Each.....			1		1		2							5	
83	AN/PRC-9.....	Each.....					1				1			1			
84	Reel equipment CE-11.....	Each.....			1		1		2								
	Switchboard:																
85	SB-22 ()/PT.....	Each.....									1			1			
86	Telephone EE-8.....	Each.....					4		5		5			5		5	
87	Terminal strip TM-164.....	Each.....														2	
88	Tool equipment TE-33.....	Each.....			2		2		5		5			6		10	
	Wire:																
89	WD-1()/TT ONRL-159.....	Miles.....			1		1		6		2			4		10	
90	WD-1()/TT INMX-300.....	Miles.....			1		1		3		4			10			
	Battery:																
91	BA-30.....	Each.....			50		5		20		40			70		100	
92	BA-270U.....	Each.....			25												
93	BA-279/L.....	Each.....					4		7		8			5		10	
94	BA-42.....	Each.....			10		10		20							50	
95	BA-43.....	Each.....			2				4		4			2		10	
	Mast section:																
96	MS-49.....	Each.....							2							4	
97	MS-50.....	Each.....							2							4	
98	MS-51.....	Each.....							2							4	
99	MS-52.....	Each.....							2							4	
100	MS-53.....	Each.....							2							4	
	Tape:																
101	TL-83.....	Rolls.....			2		2		2		2			4		10	
102	TL-192.....	Rolls.....			2		2		2		2			4		10	
	Tube:																
103	VT-146.....	Each.....														10	
104	VT-147.....	Each.....														10	
105	VT-164.....	Each.....														10	
106	VT-165.....	Each.....														10	
107	VT-221.....	Each.....														10	
108	VT-22																

¹ Consists of 1 pack T and 1 pack U.

² Consists of 3 pack T, 1 pack V, and 1 pack W.

³ For—1 antitank platoon.

1 heavy tank platoon

1 heavy tank platoon
1 engineer platoon

1 engineer platoon.

-1 antitank company.

1 heavy tank company.

1 heavy mortar comp

1 engineer company.

1 AAA A W battery.

³ Consists of 3 pack S, 1 pack Y, and 1 pack Z.

⁶ For—1 reconnaissance company.

1 signal company.

1 medical battalion, service elements.

¹ Table gives net weight of supplies in short tons. To estimate lift requirements for parachute delivery assume each bundle will deliver an average of 250 pounds net supply and calculate on basis of number of bundles a given airplane can deliver.

¹ Used by infantry battalion but included in this column to avoid excessive supply in higher echelon packs when the latter are formed from multiples of the infantry battalion pack.

Section VIII. PROCUREMENT

145. Procurement Lead Times ^{1 2}

Class I ³	12-18 months.
Class II:	
Civilian-type articles	2-12 months.
Military-type articles	6-24 months.
Class III	3 months.
Class IV:	
Civilian-type articles	2-12 months.
Military-type articles	6-24 months.
Class V	6-24 months.

¹ From time of order to time of delivery in zone of interior.

² Theaters must add order and shipping time.

³ To account for seasonal items.

Section IX. STORAGE

146. Definition of Terms

An understanding of the following terms is necessary in order to be able to use the data listed in this chapter in determining storage area requirements.

a. Storage Space. Any space, without regard to type of construction or improvement, used for storage.

b. Storage Building. Any building constructed or acquired for the storage of supplies, even though some part of it has been diverted to and is used for office, depot utility storage, or repair shops. Buildings constructed or acquired for office buildings, repair shops, depot utility storage buildings, except when they are used in whole or in part for the storage of supplies, are not considered storage buildings. The actual area used for storage purposes within such a building is considered storage space for reporting purposes.

- (1) *Warehouse.* A building designed or designated for storage purposes when constructed with roof and complete side and end walls. It may be one story or more, built at ground level or elevated to car or truck height. Presence or absence of outside loading platforms has no bearing on the classification.
- (2) *Heated warehouse.* Warehouse in which the temperature may be controlled within specified limits by the application of heat.
- (3) *Unheated warehouse.* Warehouse in which no provision has been made for heat.
- (4) *Humidity controlled warehouse.* Warehouse in which the humidity is controlled within specified limits.

- (5) *Inflammable warehouse.* Space within a building specially designated for the storage of highly inflammable materials. (Inflammable materials are those which present fire hazards.)
- (6) *Shed.* A building normally without side or end walls. A building originally constructed as a shed and subsequently closed with side and end walls becomes a warehouse upon completion of alterations and will be reported as such.
- (7) *Other covered space.* A building or portion of a building other than warehouse which is used for storage of supplies even though some part of it is used for offices, depot utility storage, repair shops, etc. The actual area used for storage purposes within such a building is considered storage space.

c. *Gross Storage Space.* The entire inside area of covered storage space, determined by using inside dimensions of building; the overall area of open storage space with no deductions for trackage and permanent roads; the actual storage space (pads) for open ammunition or toxic space.

d. *Bin Storage.* That space in which storage bins or stock racks have been erected. It includes aisles and working spaces between bins. Box pallets and pallet racks are not bins and the area occupied by them is not bin area.

e. *Aisles.* Any passageways within a storage area. Aisle space in bin areas will not be included (see above).

f. *Receiving and Shipping Space.* Gross space designated as work area for receipt and shipment of supplies and equipment.

g. *Non-Storage Space.* That area within gross space which is not used for storage because of structural losses or designation for other than storage purposes. Includes transit shed space when used or reserved for that purpose.

h. *Net Usable Space.* That portion of total gross space on which supplies can actually be stored. It does not include bin storage space, aisles, or receiving and shipping space.

i. *Open Space.* Ground area used for storage of supplies and materiel other than area used for shop stock, operating supplies, and utility supplies for use in the reporting installation. It may be a specially prepared area, an improved area or an open area in use for storage in lieu of regular storage area. Open storage space is designated under three headings as follows: improved, semi-improved, and unimproved.

- (1) *Improved.* Area having a paved, well-drained surface (asphalt, concrete and well-prepared, water-bound macadam are examples) or area which has been prepared with topping of some suitable material, or which, because of the nature of the ground (gravel or shale) and special preparation (rolling, draining, grading) gives a surface which permits vehicular traffic and year-round storage operations under ordinary circumstances and which lends itself to the storage of supplies on dunnage, "without danger of sinking of stacks." The fact that during certain seasons operations may be limited, because of weather conditions, does not change the category for reporting purposes. Improved space will include all trackage and permanent roads within the improved area.
- (2) *Semi-improved.* A partially prepared open storage area which is graded and prepared with topping of some suitable material, but which is not hard-surfaced. Semi-improved space will include all trackage and permanent roads within the semi-improved area.
- (3) *Unimproved.* Other open area which is in use for the storage of supplies, but which has not been surfaced for storage purposes.

j. Magazine (Including "Igloo"). Storage structures above or below ground, constructed for the storage of ammunition and explosives. These structures will be reported as magazines regardless of whether ammunition and explosives are actually stored in them. The *only* circumstances under which magazines will be reported under warehouse space is when the magazine has been designated as "inflammable material space" in accordance with definition heretofore. Conversely, warehouses containing ammunition will not be reported as magazines. Occupancy of magazines will be computed to include that area utilized as access aisle space contiguous to materials stored. The remainder unoccupied will be reported as vacant.

k. Tank. Space in tanks designated for the storage of supplies other than petroleum products.

l. Ammunition and Toxics. Ground area prepared or improvised for storage of ammunition or toxics in open area to supplement magazine space. It consists of prepared or improvised surfaces with or without roofing or barricaded sides. The gross area of this space

includes only the actual open storage space (pads) prepared or improvised for storage. It does not include surrounding area restricted for storage because of safety-distance factors.

m. Cold Storage Warehouse. Space in which a controlled temperature below 50° may be maintained.

- (1) Chill-cold storage space with temperature controlled between a maximum of 50° and a minimum of 32°.
- (2) Freezer-cold storage space with temperature controlled below 32°.

n. Allocated Space. Is space formally apportioned to the heads of administrative and technical services by the Assistant Chief of Staff, G-4. (Assignment of allocated storage space within a storage installation is the responsibility of the chief of the administering agency.) (See AR 700-12.)

o. Dispersed Storage Areas. Those portions of a depot or sub-installation that are geographically located away from the main establishment, but not at another reporting installation.

p. Subinstallations. Those establishments so designated by Department of the Army directives.

q. Site Area.

- (1) Site area, in covered storage, is the total land area required for buildings, spaced at minimum distances, plus all the necessary operating areas such as access roads, depot roads, railway sidings, and truck parks.
- (2) Site area, in open storage, is the total land surface required for net usable general storage area as defined above, plus that additional area required to fulfill safety regulations and to properly operate the storage facility as a whole.

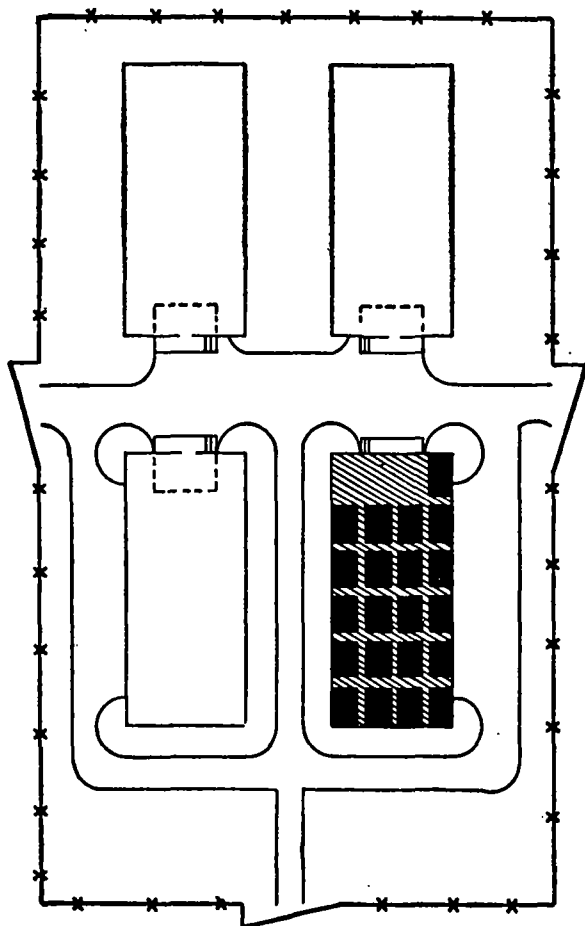
r. Gross Storage Area Factor. The gross storage area factor is the ratio of the gross storage area to the net usable general storage area. After the net usable general storage area requirement, as described above, has been determined, the gross storage area requirement is obtained by multiplying the net usable general storage area value by the pertinent gross storage area factor, as follows:

$$\text{Net usable general storage area} \times \text{gross storage area factor} = \text{gross storage area.}$$

s. Site Area Factor. The site area factor is a ratio of the site area to the gross storage area. Having determined the gross storage area requirement, the site area requirement is obtained by multiplying the gross storage area value by the pertinent site area factor as follows:

$$\text{Gross storage area} \times \text{site area factor} = \text{site area.}$$

t. Illustrating Diagram.



K E Y

-  = Net Usable Storage Area
-  +  = Gross Storage Area (in covered storage, the buildings)
-  +  +  = Site Area

147. Storage Factors

a. The following table gives optimum storage tonnage area requirements for support of military operations. These data are for general planning purposes only and may vary greatly as a result of climate conditions or the tactical situation.

	1	2	3	4	5	6	7	8
	Class	Consumed per man in theater Army plus AF short tons/man/month	Percent of tons of supplies stored		Tons/man/month of supplies stored		Gross storage area/man/month of supply	
			Covered	Open	Covered short tons	Open short tons	Covered sq. ft.	Open sq. ft.
2	I.....	0.1005	60	40	0.0603	0.0402	0.910	0.803
3	II, IV, IIA, and IVA: Air (IIA and IVA less aircraft).	.0390	(Storage provided in air depot)					
4	Chemical.....	.0009	70	30	0.0006	0.0003	.011	.009
5	Engineer: Less construction.....	.0095	20	80	.0019	.0076	.023	.152
6	Construction.....	.1092	10	90	.0109	.0983	.125	1.875
7	Medical.....	.0045	90	10	.0040	.0005	.080	.012
8	Ordnance: Less vehicles.....	.0407	20	80	.0081	.0326	.120	.644
9	Vehicles.....	.0102	0	100	.0000	.0102	.000	.276
10	Vehicle parts.....	.0077	40	60	.0031	.0046	.048	.124
11	Quartermaster: Sales items.....	.0110	90	10	.0099	.011	.133	.030
12	Less sales.....	.0041	90	10	.0037	.0004	.050	.011
13	Signal.....	.0110	30	70	.0033	.0077	.045	.210
14	Transportation.....	.0020	5	95	.0001	.0019	.001	.034
15	III and IIIA: Bulk POL (Avn).....	.1380	(Tank Farm)					
16	Bulk POL.....	.1455	(Tank Farm)					
17	Solid fuel.....	.1320	0	100	.0000	.1320	.000	2.640
18	Packaged POL.....	.0135	10	90	.0014	.0121	.021	.327
19	V and VA: V (including 10% of VA) ¹	.1304	10	90	.0130	.1174	.195	2.350
20	VA.....	.0527	(Storage provided in air depot)					
21	Totals.....	.9624			0.1203	0.4669	1.762	9.753
22	C1, II, III (Pkgd) and IV.....	.3248	33	67	.1073	.4669	1.567	4.763
23	C1 III Solid Fuels.....	.1320	0	100	.0000	.1320	.000	2.640
24	C1 V.....	.1304	10	90	.0130	.1174	.195	2.350

¹ Army supporting Air will store small arms ammunition which is estimated to be 10% of total.

b. Average ratio of gross storage area, open to covered, by classes of supply.

	<i>Ratios of gross storage area open to covered</i>	
All classes (except bulk POL).....	5.5	1
C1 I, II, III (Pkgd and Solid), and IV.....	4.7	1
C1 I, II, III (Pkgd), and IV.....	3	1
C1 V (including 10% of V-A).....	12	1

148. Storage Space Conversion Factors

The following table indicates the net usable general storage area (sq. ft.) occupied per short ton:

	1	2	3	4	5
1	Branch	Type of storage			
		Covered storage	Open storage	Igloo and magazine	Open storage ammunition
2	Ordnance Corps.....	10.0	18.0	7.0	11.0
3	Signal Corps.....	10.0	16.0	-----	-----
4	Corps of Engineer.....	8.0	13.0	-----	-----
5	Chemical Corps.....	12.5	20.8	7.0	11.0
6	Army Medical Service.....	13.0	16.0	-----	-----
7	Quartermaster Corps.....	9.0	17.1	-----	-----
8	Transportation Corps.....	7.0	12.0	-----	-----
9	Adjutant General's Corps.....	10.0	-----	-----	-----

149. Average Stack Heights¹

- a.* Covered Storage. All services..... 8 ft.
b. Open Storage. All services..... 6 ft.

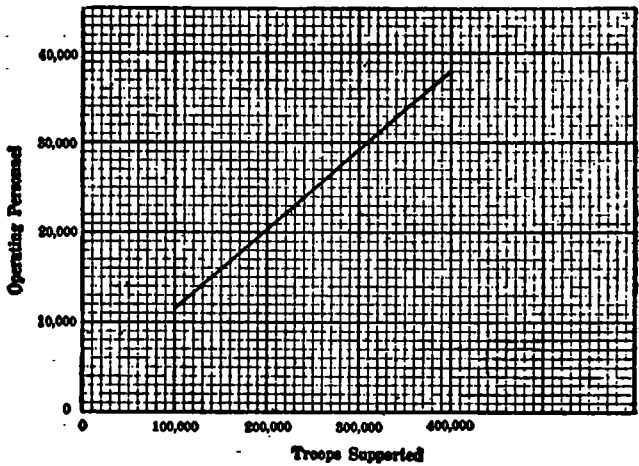
¹ Figures given are for use in theaters. For zone of interior storage, increase by 25 percent.

150. Gross Storage and Site Area Factors

	1	2	3	4	5	6
1	Class of supply	Services	Gross storage area factors ¹		Site area factors ²	
			Covered	Open	Covered	Open
2	I.....	Quartermaster.....	1.40	1.50	2.00	1.50
3	II.....	{All services.....	1.25	1.30	1.80	1.43
4		{Ordnance.....	2.00	2.00	3.00	3.00
5		{Quartermaster.....	1.40	1.50	2.00	1.50
6		{Signal.....	2.00	2.20	1.80	1.43
7	III ³	Quartermaster.....	1.25	1.30	1.80	1.43
8	IV.....	{All services.....	1.25	1.30	1.80	1.43
9		{Ordnance.....	2.00	2.00	3.00	3.00
10		{Quartermaster.....	1.40	1.50	2.00	1.50
11		{Signal.....	2.00	2.20		
12	V.....	Ordnance and chemical.....	1.25	1.25	⁴ 112.00	(⁵)

¹ Apply additional factor of 3 for storage in combat zone.
² Apply additional factor of 5 for storage of Classes I, II, III, and IV in the combat zone.
³ Excludes bulk storage of petroleum in tanks.
⁴ These factors take into consideration the great amount of dispersion necessary as a safety precaution in storing ammunition.
⁵ See par. 152.

151. Operating Personnel Required for all Storage Within a Theater*



*May include prisoners of war and civilians as available.

152. Miscellaneous Factors

Ammunition storage per mile of road ¹	1,000 short tons.
Ammunition storage per square mile ¹	5,000 short tons.
Minimum hard standing requirements for 2,500 vehicles ²	110,000 sq. ft.
Solid footing for vehicle park for 2,500 vehicles.....	4,000,000 sq. ft.
Minimum hard standing requirement for artillery and combat vehicles, per item.	350 sq. ft.

¹ Refers to temporary storage of ammunition along roadways and in urban fields and forests much as may be found in combat zones.

² Data based on the assumption that hard standing area will not be required for the total number of vehicles at any one time.

153. Handling of Supplies

a. Labor Requirements.

- (1) *Hand operations.* For long-term planning purposes, labor requirements for handling supplies by hand are computed on the average of $\frac{1}{2}$ ton per man per hour for 10 hours each day. For short periods, the average is much higher.
- (2) *Mechanical handling.* For planning purposes, the labor requirements for handling supplies by use of mechanical equipment, such as fork-lift trucks and tractor-trailer trains, are normally limited to a working foreman and equipment operators to operate the mechanical equipment necessary to efficiently handle these supplies.

b. Handling Crews.

- (1) *Hand operations.* The maximum number of men that may be employed advantageously in loading or unloading one freight car is nine (one working foreman and eight laborers). The maximum crew for loading or unloading average loads by hand on Army trucks is five men (one working foreman and four laborers).
- (2) *Mechanical handling of palletized loads.* The maximum number of men required to advantageously load or unload one freight car or truck of palletized supplies using mechanical handling equipment is three (one working foreman and two materials handling equipment operators).

c. Time Estimate (based on manual handling).

- (1) The time estimate for average packaged or bundled military loads* at depots, supply points, or using units, under average conditions, a 5-man crew for each truck or trailer, and the number of trucks or trailers to be loaded or unloaded simul-

*See chapter 7 regarding authorized 100 percent overload for certain vehicles under some conditions and double time estimates when necessary.

RESTRICTED—Security Information

taneously, dependent upon amount of labor available, is as follows:

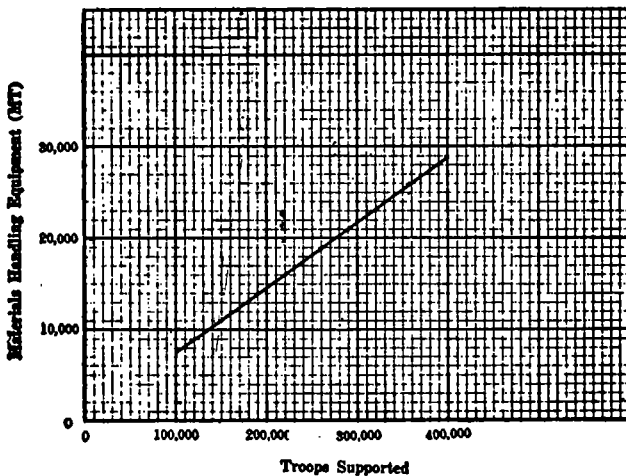
<i>Loading and unloading</i>	<i>2½-ton truck 1-ton trailer</i>	
Average time.....	50 min.	20 min.
Minimum time.....	30 min.	12 min.

(2) For prescribed *loads*, under field conditions, where the amount of labor available is unlimited:

	<i>Day</i>	<i>Night</i>
Unloading.....	15 min.	30 min.
Loading.....	30 min.	60 min.

154. Materials Handling Equipment Requirements

A depot supplying 100,000 men will require approximately 7,700 measurement tons of materials handling equipment, including conveyors, pallets, scales, tractors, trailers, forklift trucks, hand-trucks, lumber-straddle trucks, stock-picker trucks, etc.

**155. Illustrative Problems**

a. Situation, Problem A. To determine storage requirements for a theater of operations requiring 100,000 measurement tons of Class I supplies.

b. Solution, Problem A. Storage area requirements:

A measurement ton (MT)=40 cu ft.

Therefore, $100,000 \text{ MT} \times 40 = 4,000,000$ cu ft of supplies to be stored.

Minimum percentage of covered storage required is 60 percent (see par. 147).

Therefore, 40 percent open storage required.

$60 \times 4,000,000 \text{ cu ft} = 2,400,000 \text{ cu ft}$ of supplies requiring covered storage.

$40 \times 4,000,000 \text{ cu ft} = 1,600,000 \text{ cu ft}$ of supplies to be stored in the open.

Average stack heights (see par. 149):

Covered storage=8 feet.

Open storage=6 feet.

$2,400,000 \text{ cu ft} \div 8 \text{ ft} = 300,000 \text{ sq ft}$, net usable area of covered storage required.

$1,600,000 \text{ cu ft} \div 6 \text{ ft} = 267,000 \text{ sq ft}$, net usable area of open storage required.

Gross storage areas for each type of storage are based on net usable areas. Factors for computations, as found in paragraph 150, are—

Covered storage=1.40

Open storage=1.50

(Assume storage is to be in communications zone; hence additional combat zone factor of 3 is not required.)

$300,000 \text{ sq ft} \times 1.40 = 420,000 \text{ sq ft}$, gross storage area required for covered storage.

$267,000 \text{ sq ft} \times 1.50 = 400,500 \text{ sq ft}$, gross storage area required for open storage.

Site areas for each type of storage are based on gross storage areas. Factors for computations are found in paragraph 150.

Covered storage=2.00

Open storage=1.50

(Assume storage is to be in communications zone; hence additional combat zone factor of 5 is not required.)

$420,000 \text{ sq ft} \times 2.00 = 840,000 \text{ sq ft}$, site area required for covered storage.

$400,500 \text{ sq ft} \times 1.50 = 600,750 \text{ sq ft}$, site area required for open storage.

Total site area required:

Covered storage= 840,000 sq ft

Open storage= 600,750 sq ft

1,440,750 sq ft

$1,440,750 \text{ sq ft} \div 43,560 \text{ sq ft (1 acre)} = 30.7$ say 31 acres of site area required.

c. *Situation, Problem B.* To determine operating personnel and materials handling equipment requirements for all storage in a theater which has a strength of 250,000 men.

d. *Solution, Problem B.*

- (1) *Part I, operating personnel requirements.* (See graph, par. 151.) On the horizontal scale of this graph, locate the vertical line representing 250,000 men. This line crosses the oblique graph line at the horizontal line representing 24,500 operating personnel as indicated on the left margin. Therefore, for general planning purposes, 24,500 men are needed to operate theater depots.
- (2) *Part II, materials handling equipment requirements.* Using the same assumption for theater strength as used in part I above, the graph in paragraph 154 shows that for 250,000 men, 18,500 measurement tons of materials handling equipment will be required.

156. Characteristics of Materials Handling Equipment

1	1	2	3	4	5	6	7	8	9	10	11
	Item*	Dimensions			Weight (lb)		Dis- place- ment (cu ft)	Capacity		Method of operation	Primary use
		Length (in)	Width (in)	Height (in) min- imum	Oper- ating	Ship- ping		Load (lb)	Height (ft)		
2	Trucks, fork lift.....	94	28	80	3, 520	4, 300	140	2, 000	9	Gasoline..	Useful in moving and stacking palletized loads. Not efficient to move supplies over horizontal dis- tances greater than 250 ft.
3		97	33	83	3, 880	4, 480	146	2, 000	9	Electric...	
4		110	38	83	5, 400	6, 600	186	3, 000	9	Gasoline..	
5		100	34	83	5, 350	6, 500	150	3, 000	9'5"	Electric...	
6		143	42	83	10, 700			6, 000	14	Gasoline..	
7		122	43	83	10, 460	11, 800	226	6, 000	9'11"	Electric...	
8		196	86	150	15, 800	16, 400		15, 000	17'6"	Gasoline..	
9		158	59	83	16, 500	18, 800	375	10, 000	8'2"	Electric...	Primarily for transporting unit loads short dis- tances. May be used for stacking. Less expen- sive than fork lift trucks, but less maneuverable.
10	Trucks, platform.....	128	41	83	4, 810			4, 000	8'6"	Gasoline..	
11		82	34	48	1, 150	2, 000	118	3, 000	0	Electric...	
12		131	43	58	4, 000	4, 910	229	6, 000	1'4.5"	Gasoline..	
13		126	41	54	3, 825			10, 000	1'4"	Gasoline..	
14		150	44	102	8, 500	10, 300	465	20, 000	5'2"	Electric...	
15		160	53	107	12, 600	14, 400	450	30, 000	2'5"	Electric...	
16								Draw bar pull (lb)			Used for drag towing on skids or towing one or more trailers. Tractor is small and maneuverable. Should be used for moving when distance exceeds 250 ft.
17	Tractors, warehouse.....	112	64	52	2, 260	2, 400	162		1, 600	Gasoline..	
18		92	42	52	2, 750	3, 850	174		2, 200	Gasoline..	
19		68	39	57	3, 170	3, 700	149		2, 600	Gasoline..	
20		117	69	76	4, 660				3, 300	Gasoline..	
21		99	60	60	4, 000				5, 000	Gasoline..	
22		130	89	72	10, 900	13, 200	480		7, 500	Gasoline..	
23		77	41	59	3, 400	3, 970	142		2, 100	Electric...	

RESTRICTED—Security Information

156. Characteristics of Materials Handling Equipment—Continued

	1	2	3	4	5	6	7	8	9	10	11
1	Item*	Dimensions			Weight (lb)		Dis- place- ment (cu ft)	Capacity		Method of operation	Primary use
		Length (in)	Width (in)	Height (in) min- imum	Opera- ting	Shlp- ping		Load (lb)	Height (ft)		
24								Load (lbs)			
25	Cranes, wheeled, fixed boom...	135	60	186	12,300	13,400	-----	-----	6,000	Gasoline..	Handles loads of shapes and sizes which are moved with difficulty by other equipment.
26		150	66	204	16,500	2,000	730	-----	10,000	Gasoline..	
27		150	78	212	21,000	23,900	-----	-----	14,000	Gasoline..	
28	Cranes, wheeled, slung-----	135	43	77½	5,200	6,450	310	-----	2,000	Electric...	Used extensively for moving lumher, poles, pipe, rods, and girders.
29		130	70	264	14,000	-----	-----	-----	5,000	Electric...	
30		130	62	231	15,000	-----	-----	-----	10,000	Electric...	
31		157	93	372	34,500	39,000	-----	-----	20,000	Gasoline..	
32	Trucks, straddle-----	130	71	89	7,000	-----	-----	-----	10,000	Gasoline..	
33		147	78	126	9,000	13,200	910	-----	14,000	Gasoline..	
34		187	90	126	12,100	17,200	955	-----	20,000	Gasoline..	
35		187	104	140	13,500	19,200	1,130	-----	30,000	Gasoline..	

*All items of materials handling equipment not listed here. Typical items of varying capacities are listed. For more complete information, see TM 10-1619.

Section X. DISTRIBUTION

157. Routine Requisition and Shipping Times ¹

OVERSEA THEATERS TO ZONE OF INTERIOR

	<i>Days</i>
Consolidating inventories and preparation of requisition in theater.....	15
Air mail time to port of embarkation.....	5
Port of embarkation edits and extracts requisition.....	10
Mail time to depot in zone of interior.....	5
Depot processes requisition and sets up shipment.....	30
Transit time from depot to port of embarkation.....	10
Port of embarkation loads and ships.....	15
Transit time from port of embarkation to theater.....	20
Port of discharge unloads supplies.....	10

Total elapsed time from date requisition initiated until the supplies are available for issue in theater of operations..... 120

¹ Days shown are for illustration purposes only and represent time intervals for processing routine bulk shipments of supplies. Such intervals will increase or decrease in proportion to the distance of the theater from the zone of interior, distances within the theater, and transportation and other handling facilities. Total elapsed time for emergency requisitions for supplies shipped by air may be as low as 5 days.

² Days shown assume that the supplies are carried in stock. Requisitions for supplies which require special procurement may increase this period 6 or 12 months.

158. Build-Up of Supply Levels

a. For estimation of requirements where it is desired to build up a certain level of supplies by a given date, at the same time adequately supplying present and future contemplated operations during the build-up period, the following formula is useful:

$$S = C \left(1 + \frac{L}{T} + W \right)$$

where

S equals *shipping requirements* during the build-up phase, expressed in pounds per day.

C equals *consumption* (average) in pounds per day.

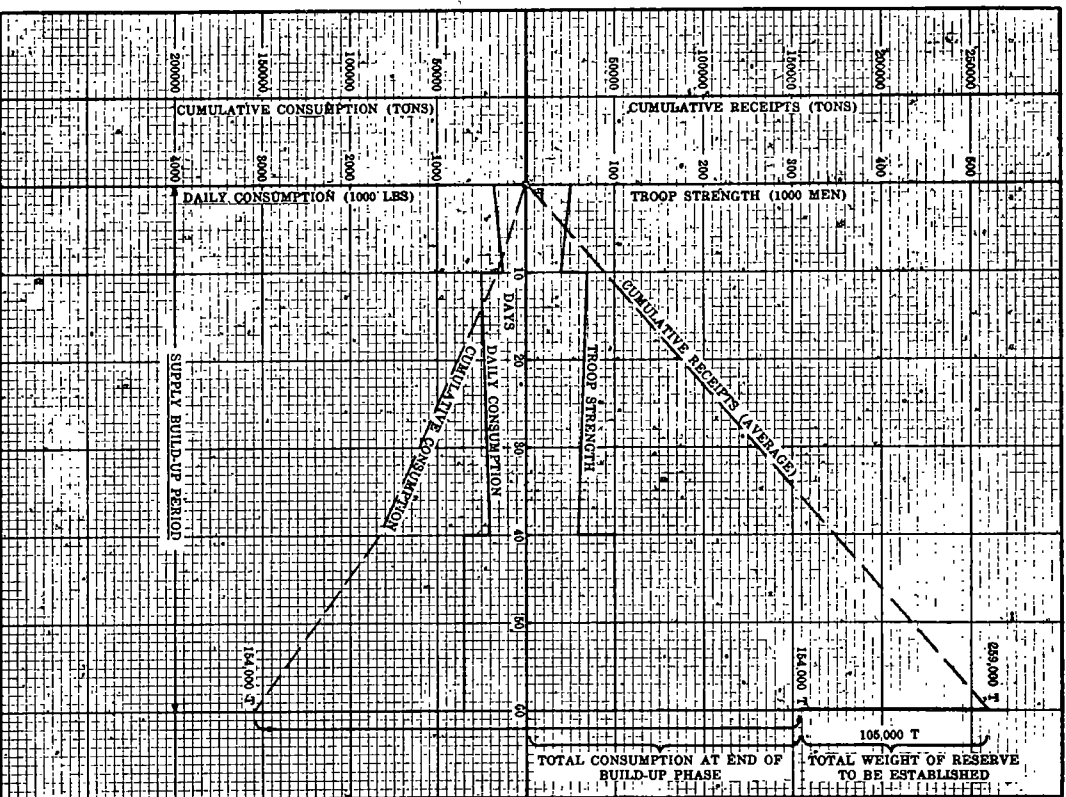
W equals a *wastage factor* (percentage of total consumption expressed as a decimal). This factor is based on experience in the particular theater and normally ranges from 0 to .25.

L equals the *supply level to be attained*, expressed in days of supply.

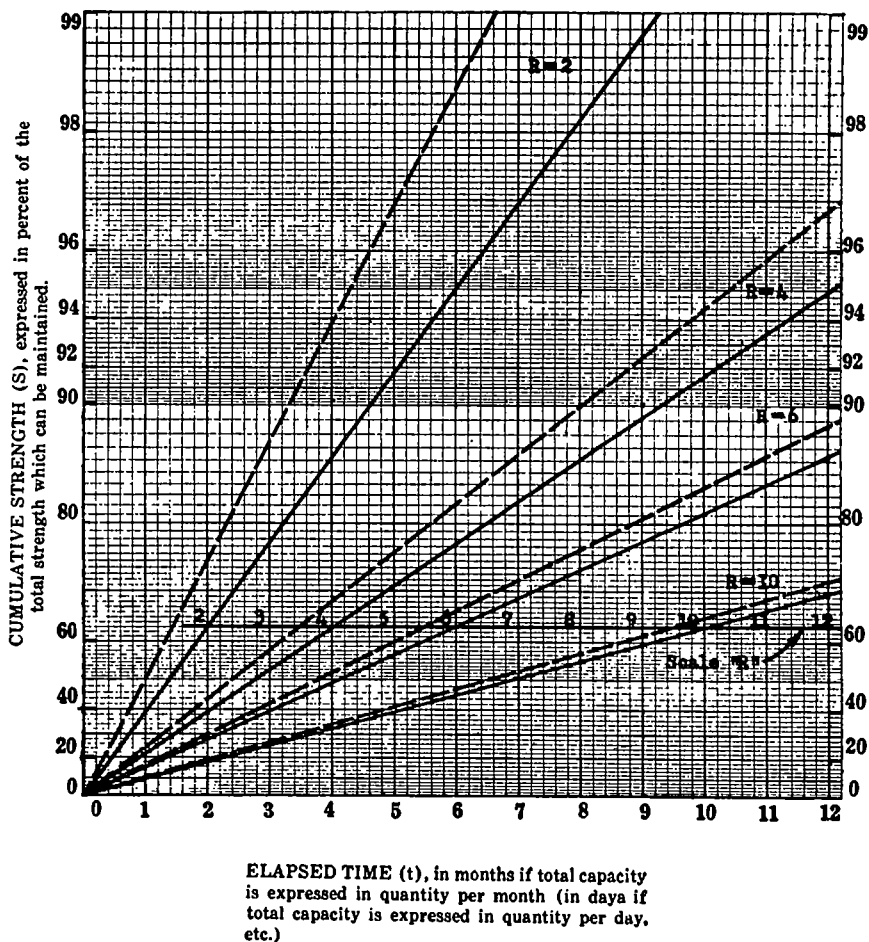
T equals *time length of build-up phase* in days.

(Given any four of the factors, the fifth can be determined by transposing.)

b. Since the formula in a above assumes a constant troop strength, a chart similar to the following may be used to show the relation between changes in troop strength, the cumulative consumption, and cumulative receipts in the establishment of a specified level of supply during a given build-up period.



159. Lines of Communication Build-up Capacity.



a. General.

- (1) The preceding chart indicates the maximum cumulative strength which can be built up in the shortest time, using lines of communications of fixed capacity, if those lines of communications also carry replenishment loads for personnel previously transmitted.
- (2) The chart is applicable to situations in which maintenance loads are directly proportional to loads previously carried (initial loads), and has been prepared for the values 2, 4, 6, and 10 of "R" (ratio of initial to maintenance loads). Addi-

tional lines can be added readily to the chart for additional values of "R."

- (3) For each value of "R," there are shown two lines on the chart—one solid and one dashed. For each value of "R," use of the solid or dashed line in computations depends upon the assumption applicable to the situation—
 - (a) The solid-line curve in each case is based on the assumption that at any time "t", the strength being served on a maintenance basis, is equal to the accumulation of strength previously served on an initial basis (that is, maintenance begins immediately upon passage, and initial loads are not alternately depleted and replenished).
 - (b) The dashed-line curve in each case is based on the assumption that the increment of strength served on an initial basis in any one month will be served on a maintenance basis during the following month (that is, initial loads would be depleted, on the average, by approximately 15 days' maintenance supply before replenishment would begin).

b. Construction of Curves for Additional Values of "R." To construct curves for values of "R," other than those shown, proceed as follows:

- (1) For solid lines (see assumption above), draw a straight line through the origin (0,0) and the point on Scale "R" representing the value of "R" (ratio initial/maintenance loads).
- (2) For dashed lines (see assumption above), draw a straight line through the origin (0,0) and the point on scale "R" which is less by 0.5 than the value of "R."

c. Examples of Use of Chart. This chart may be used in calculations relating to the movement of troops or supplies through a port of embarkation or, analogously, to their movement over any available lines of communications—for example, a railroad, a highway, an air transport route. It can be used to determine the time it would take to reach various strengths, the strength which can be accumulated in any amount of time, and the necessary ship loads of initial or maintenance supplies. The ratio "R" may be based on space requirements; number of cars, ships, tonnages; number of individuals; etc.

(1) *Example 1*

- (a) *Problem.* The capacity of a port is 300,000 MT/month. Initial equipment for troops moving through the port = 4.8 MT/man: supplies for maintenance of troops moved through the port = 0.8 MT/man/month. What strength can be built up through this port in 7 months if mainte-

nance supply for the troops begins immediately with their passage?

(b) *Solution.*

1. $R = \text{initial} \div \text{maintenance load} = 4.8 \div 0.8 = 6$.
2. $t = \text{time elapsed} = 7 \text{ months}$.
3. From the chart, locate $t=7$ on the horizontal scale, and continuing vertically upward to the intersection of $t=7$ with the *solid* line for $R=6$, read "Cumulative Strength (S)" from the vertical scale = 69 percent of the total strength which can be maintained.
4. Total strength which can be maintained = $300,000 / 0.8 = 375,000$ troops.
5. Therefore, cumulative strength after 7 months = 69 percent of 375,000 = 259,000 troops.

(2) *Example 2.*

(a) *Problem.* Assuming the same circumstances in Example 1, above, how many new troops will be moved through the port during the seventh month?

(b) *Solution.*

1. Proceed as in the solution to Example 1, above, except determine the Cumulative Strength after 6 months = 64 percent of the total strength which can be maintained.
2. From the solution to Example 1 and the foregoing, it is observed that from the end of the sixth to the end of the seventh month (that is, during the seventh month), the cumulative strength changed from 64 percent to 69 percent of the total strength which could be maintained.
3. Therefore, the new troops moved in during the seventh month represent 69 less 64 percent = 5 percent of the total strength which can be maintained = 5 percent of 375,000 = 18,750 troops.

(3) *Example 3.*

(a) *Problem.* Assuming the circumstances as in Example 1, above, *except* that the maintenance factor of 0.8 MT/man/month is so established that maintenance can start during the following month for all troops moved initially during any one month, what could be the strength built up after 7 months?

(b) *Solution.*

1. Proceed as in the solution to Example 1, above, except that in using the chart, use the *dashed* line for $R=6$ instead of the solid line.

RESTRICTED—Security Information

2. Read cumulative strength=72 percent of the total strength which can be maintained.
 3. Cumulative strength after 7 months=72 percent of 375,000=270,000 troops.
- (4) *Example 4.*
- (a) *Problem.* Initial and maintenance supplies for service forces are to be moved over a highway the capacity of which is 10,000 short tons per month. Initial equipment for these forces averages 3,350 pounds per man; maintenance averages 430 pounds per man per month. When will the size of the service force have been built up to 60 percent of its ultimate strength, if maintenance supply must begin immediately upon passage of the forces?
 - (b). *Solution.*
 1. $S=60$ percent of the maximum which can be supported.
 2. $R=3,350/430=7.8$.
 3. Inasmuch as no line for $R=7.8$ appears on the chart, it must be constructed. Observing the assumption in the problem above as to initiation of maintenance, draw a *solid* line through (0,0) and the point 7.8 on Scale "R" (in accordance with directions above).
 4. Using the constructed line, as indicated in previous examples, determine for $S=60$ percent that " t "=7 months.

160. Combat Zone Supply Installations*a. Introduction.*

- (1) Listed below are the army supply installations usually found within the combat zone, showing in detail the class of supply for which each technical service is responsible and the normal supply installations for each class of supply. For each class of supply (column 1), three things are shown—in column 2, the depots found in the army maintenance area; in column 3, the supply points required to support the corps; and in column 4, the normal procedure by which divisions or similar using units draw the specific class of supply.
- (2) The supply system within the army must be simple and, above all, flexible to meet changing situations. Keep in mind the mission, terrain, weather, road, and railnets in selecting supply installations.
 - (a) On the offensive, one would expect the supply points to be well forward and contain at least 2 to 3 days of supply for the unit or units being served. As a general rule, one

would expect to find a Class I, a Class III' and a Class V supply point supporting each corps, located well forward in the area but out of heavy artillery range. Engineer Classes II and IV supply points might also be established if the conditions of roads and bridges require large quantities of construction materials. In addition to the medical depot, there normally will be two advance medical supply points each supporting forward evacuation hospitals and divisions.

- (b) On the defensive, the engineer Classes II and IV supply points should be located well forward, containing fortification materials. The other supply points should be located farther to the rear and normally would carry from 3 to 5 days' level for the troops supported.
- (3) Supply points serve all units in the area. (If army troops are located near a supply point, then that supply point will serve those units.) All army supply points are operated by army troops. All supply installations located in the corps or division area are cleared for area locations by corps or division before they are established.
- (4) These are general rules of the thumb that can be used in establishing an efficient supply system to support an army. An army G4 and the technical service officers will have to be on the alert to meet changing situations—always planning ahead to have supplies available when needed.
- (5) This study shows the type of supply installations needed to support a field army under normal conditions. However, it must be realized that ground reconnaissance is the only method for selecting sites for installations.

b. Installations.

¹ The phrase "consolidate supply requirements" means for the unit to consolidate into *one requisition* the requirements for its subordinate and attached units.

The phrase "assemble supply requirements," means for the unit to collect and edit the supply requirements for its subordinate and attached units and forward these requirements as *separate requisitions for each subordinate unit*.

Normal procedure is for divisions to include supply requirements for units attached to the

division. This procedure is followed except when the unit is attached for a short period of time.

² General levels established by theater which are considered a part of theater stocks do not include levels in supply points, except for Class V supplies.

³ Nature of terrain and lines of communications sometimes require additional supply points to support one corps.

⁴ Normally, units of the division will come to quartermaster trains area to pick up their Classes II and IV requirements.

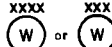
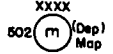
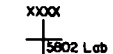
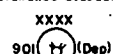
RESTRICTED—Security Information

1 Item	2 Army Maintenance Area	3 Corps Area	4 Unit Supply Procedure ¹
1 Chemical Classes II & IV	1. Installation: Chemical Classes II and IV depot. XXXX 301 (Dep) 2. Conventional sign: 3. One such depot normally in army maintenance area. 4. Normally for retail issue; however, wholesale issue is made to supply points if necessity for establishment of supply points arises. 5. Operated by one or more chemical depot companies depending on size of army and on gas warfare or non-gas warfare conditions. 6. Levels established by theater. Will normally be 15 days.² 7. Covered storage required—approximately 80 percent. 8. Maintenance is furnished in or adjacent to this depot for chemical material by chemical maintenance companies.	1. Installation: Chemical Classes II and IV supply points. XXXX 303 (Sup Pt) 2. Conventional sign. 3. Normally one per corps operated by chemical service battalion. 4. Normally retail issue. 5. Levels established by army. 6. Covered storage required—approximately 80 percent. 7. Maintenance is furnished in or adjacent to this supply point by chemical maintenance company of service battalion.	1. Regiments and separate units will consolidate and submit requirements of subordinate elements to division chemical officer. 2. Division chemical officer consolidates requirements of division and submits requisition direct to army chemical officer or depot. If supplies are regulated requisitions are submitted to army chemical officer for approval based on army or corps commanders priorities. 3. Upon notification by army that supplies are ready, division chemical officer arranges with division G-4 for transportation to pick up the supplies and to deliver them to division trains area where supplies are broken down by division chemical officer. 4. Division units, upon notification by division chemical officer will pick up supplies from division trains area. 5. Corps troops submit requirements to corps chemical officer who then assembles the requirements and requisitions on army chemical depot. 6. When supplies are ready for issue, corps troops will normally draw directly from army chemical depot.
2 Chemical Class V	1. Installation: Chemical Class V depot. XXXX 302 (Dep) 2. Conventional sign: 3. One such depot normally located in army maintenance area in close proximity to the ordnance Class V depot. Depending on the army commander's desire it may be established as part of ordnance Class V depot, with the ordnance Class V conventional sign. 4. Wholesale issue to corps and divisions, retail to army troops. 5. Operated by one or more chemical depot companies depending on size of army and on gas or non-gas warfare conditions. 6. Levels established by theater. Normally 15 days of operation.² 7. Covered storage required—negligible. 8. When required, army allocates Class V supplies to corps. Copy of allocation to supply point. 9. Mixed flame thrower fuel is normally carried in Class V depot. (Where units do their own mixing, they draw gasoline from Class III supply point serving them and draw Napalm from chemical Classes II and IV depot.)	1. Installation: Chemical Class V supply point. XXXX 304 (Sup Pt) 2. Conventional sign: 3. One or more of these supply points may be established in corps area depending on needs of using troops located in close proximity of the ordnance Class V supply point. Depending on the army commander's desire it may be established as part of the ordnance Class V supply point, with the ordnance Class V conventional sign. 4. Retail issue to corps and divisions. 5. Operated by section or platoon of chemical depot company. 6. Levels established by army; usually 2 to 3 days of operation. 7. When required, corps allocates Class V chemical supplies to divisions and corps troops. 8. Supply point receives copies of army and corps allocations. 9. See note 9 in column 2.	1. Regiments and separate units will draw ammunition from the army Class V supply point supporting corps, based upon transportation order approved by division ammunition officer. Normally the quantity requested is to replace the basic load. 2. Corps troops accomplish their own transportation order, or equivalent, and draw requirements directly from Class V supply point in corps area. 3. Corps controls the issue of Class V chemical supplies to corps troops, if necessary. 4. Division, if necessary, controls the issue to subordinate units. 5. All ammunition issues are coordinated through division ammunition office. 6. Division units will draw ammunition directly from army supply point.
3 Engineer Classes II & IV	1. Installation: Engineer Classes II and IV depot. XXXX 501 (Dep) 2. Conventional sign: 3. Normally one per army located in army maintenance area. 4. Operated by engineer depot company (TO&E 5-267A). 5. Level—15 days (5,000–20,000 tons).² Large quantities of construction materials, lumber, steel, and road material, may be procured locally and not pass through the depot system. 6. Class II—issued on replacement or exchange basis on receipt of requisition approved by engineer supply officer of divisions and corps troops. Requests in excess of allowances require corps and army engineer approval. 7. Class IV—issued on informal request of unit engineer supply officer. 8. Regulated items—issued on army priorities or allocations on instructions from army engineer. 9. Maintenance companies maintain small stocks of fast moving items and issue first and second echelon parts to units. Replenishment is from army engineer depots.	1. Installation: Engineer Classes II and IV supply points. XXXX 501 (Sup Pt) 2. Conventional sign. 3. Normally one per corps. Operated by Engineer Supply Point Company (TD&E 5-48). 4. Level—3 days (250–400 tons). Stockage generally consists of fortification or bridge materials. Corps bridge units may carry additional stocks of bridging materials. 5. Maintenance companies maintain small stocks of fast moving items and issue first and second echelon parts to units. Replenishment is from army engineer depot. 6. Army stocks these supply points based on daily withdrawals and expected operations.	1. A division engineer dump carrying limited quantities of selected items may be operated by the division engineer battalion. It is located either at the headquarters and headquarters company of the engineer battalion or is consolidated with other divisional services near the rear echelon. In any case, camouflage materials may be left in the infantry regimental area, when desired. 2. Class II—Units requisition through division engineer. 3. Class IV—Units request informally through division engineer. 4. Regulated items require approval of army engineer before items can be drawn from army depot or supply points based on army or corps commander's priorities. 5. Supplies are brought to the division area by division engineer using division engineer or division transportation. 6. Spare parts may be obtained through depot system or through supporting engineer maintenance company.

RESTRICTED



RESTRICTED—Security Information

1 Item	2 Army Maintenance Area	3 Corps Area	4 Unit Supply Procedure ¹
4 Engineer Water	1. Conventional sign  2. Normally one per army. 3. Production: 540,000 gal—1 day. 4. Distribution: 14,400 gal tank load. 5. Storage capacity: 108,000 gal. 6. Used to supplement water sources of army, corps, and division engineers; to transport water to units without a sufficient local source; and to transport water to installations which use large quantities of water and have inadequate means to transport it.	1. Installation Engineer water point. 2. Conventional sign:  3. One to four points may be established by each corps and army engineer battalion. 4. Maximum production, each battalion—168,000 gal. 5. Maximum storage, each battalion—36,000 gal. 6. Issue is made to all consumers who arrive at water point with empty containers. 7. Amphibious or airborne operations—water points of organic units can be in operation on D-day, four hours after arriving at source. Five days of supply often taken ashore in 5-gal drums and 55-gal drums and issued with Class I supplies.	1. Installation: Division water point. 2. Conventional sign:  3. One to four points may be established by the division engineer battalion. 4. Production and storage capacity same as for corps engineer battalion. 5. Issue is made to unit kitchen trucks and water trailers which are sent to water points and transport water to unit kitchens.
5 Engineer Maps	1. Installation: Engineer map depot.  2. Conventional sign. 3. Normally one in army maintenance area located near Army headquarters. 4. Operated by map reproduction and distribution company. 5. Issues made to army troops, corps, and divisions on basis of army Table of Map Allowances. 6. Normally one engineer topographic battalion performs new mapping, photomapping, reproduction, survey methods. Lithography and contact prints—size 22" x 29". 7. Maps are obtained from army topographic battalion and base map depots in communications zone.	1. Corps may operate map depot to supply division and corps troops. 2. Issues made to corps troops and divisions on basis of Army Table of Map Allowances. 3. Maps obtained from corps topographic company and army topographic Bn.	1. Division troops receive maps from division engineer battalion which distributes maps under the staff supervision of division G-2. 2. Division engineer obtains maps from the corps engineer. 3. Division usually requires one strategic map, one road map, and two tactical maps.
6 Medical Classes II & IV	1. Installation: Medical Classes II & IV depot.  2. Conventional sign. 3. Normally one per army located in army maintenance area. 4. Operated by medical depot company (TO&E 8-67). 5. Army level—15 days.² 6. Depot restocks advance supply points and makes retail issues to units located in army service area. 7. Regulated items require approval of the army surgeon based on army commander's priorities. 8. Ninety percent of supplies require covered storage.	1. Installation: Medical Classes II & IV supply point.  2. Conventional sign. 3. Located within easy reach of evacuation hospitals. 4. Normally there will be two advance supply points (supporting all corps) with the primary mission of making bulk issues to division and retail issues to other units and hospitals. 5. Operated by section of a medical depot company. 6. Issues are made in accordance with authorized allowances or allocations. 7. Supply points are restocked by sending transportation to the medical depot. 8. Level—2 to 3 days.	1. Division medical battalion consolidates the requirements of the units of the division and draws in bulk from the nearest medical supply point. 2. Medical battalion draws supplies and hauls to the division area where supplies are broken down and issued to units. 3. Army medical units draw direct from nearest medical supply point.
7 Medical Laboratory	1. Installation: Medical laboratory.  2. Conventional sign. 3. Located in army maintenance area. 4. Carries a stock of laboratory supplies for army medical units.		Army medical units draw laboratory supplies from army medical laboratory located in army maintenance area.
8 Ordnance Classes II & IV	1. Installation: Ordnance Classes II and IV depot.  2. Conventional sign: 3. a. Normally of two types, wholesale and retail. There is one wholesale depot located in the army maintenance area. It is operated by the army depot battalion consisting of approximately four depot companies. It issues only to depot companies operating retail depots and to the army field shop. Located in center of maintenance area to support depot companies. Normal level—15 days for the army.	1. Nondivisional units are supplied by ordnance maintenance companies supporting them. All ordnance maintenance companies are army ordnance units. 2. Nonregulated items issued on requisition or direct exchange of serviceable items for unserviceable items. 3. Regulated items issued on allocations by corps or army. 4. Using unit need have contact with one ordnance unit only in dealing on all supply or maintenance matters. 5. Supply level—15 days for units supported plus sufficient supplies for own shop activities.	1. Regiments consolidate requirements for companies and submit to division ordnance unit; separate companies or battalions consolidate requirements and submit to division ordnance unit. 2. Division ordnance unit consolidates ordnance Class II and IV requirements for division and attached units and draws from army ordnance retail depot. 3. Division ordnance unit hauls from retail depot to division ordnance bivouac where supplies are broken down and issued to major units. 4. Major items may be delivered to division ordnance unit by army ordnance unit.

RESTRICTED



RESTRICTED—Security Information

1	2	3	4
Item	Army Maintenance Area	Corps Area	Unit Supply Procedure ¹
8 Ordnance Classes II & IV (continued)	b. Retail depots issue to ordnance maintenance units only, including division ordnance units. One in each forward heavy support battalion and one in the army service heavy support battalion. Operated by Ordnance Depot Co (Army), TO&E 9-57. Normal supply level is 15 days of selected items for units supported. 4. Vehicles, trailers, and artillery weapons are received, stored, and distributed by an ordnance vehicle and artillery park company. Distribution is through maintenance channels. Located in rear of army maintenance area, and if possible near a railhead.		
9 Ordnance Class V	1. Installation: Ordnance Class V depot. XXXX 910 (Dep) 2. Conventional sign: 3. Normally one ammunition depot located in the army maintenance area. 4. Operated by ordnance ammunition battalion. 5. Receives Class V supplies from communications zone. Maintains principal reserve and distributes to ammunition supply points as directed by army ordnance officer. 6. May store and issue chemical Class V. 7. Normal level established by theater—15 days operation.² 8. This depot should be located as far forward in the maintenance area as possible due to heavy tonnages it must handle, if possible rail into or in close proximity to the depot.	1. Installation: Ordnance Class V supply point (ASP). XXXX 911 (Sup Pt) 2. Conventional sign: 3. Normally one per corps. Number may be increased as required to fulfill responsibility of army to place adequate supplies within easy reach of combat units. 4. Operated by army ordnance. One or more ammunition companies required, depending upon quantity of supplies handled. 5. When necessary, army controls the issue of Class V to corps and comps, in turn, controls the issue to divisions and corps troops. 6. When such controls of Class V are necessary, army and corps send information copies of these controls to the ammunition supply point from which ammunition will be drawn. 7. Units draw direct from supply points based on transportation order and haul with unit transportation. 8. Level—for 3 to 5 days operation. 9. May store and issue chemical Class V. 10. Supply points are stocked daily by army based on the days issue.	1. Regiments and separate battalions consolidate requests from companies or batteries and submit to division ammunition officer. 2. Requests are approved by the division ammunition officer (DAO). After approval by the DAO, requests become transportation orders. 3. Requests are not consolidated by the DAO. 4. Requests are normally the quantity required to replenish basic load.
10 Quartermaster Class I	1. Installation: Class I depot. XXXX 601 (Dep) 2. Conventional sign: 3. Normally not more than one located in army maintenance area. Located well forward in maintenance area. 4. Operated by one QM Subsistence Depot company and five service companies. 5. Can handle supplies for force 325,000 to 400,000 troops. 6. Unless items such as flour, sugar, etc. are in waterproof containers—limited covered storage is desired. 7. Levels are established by theater. Normally Class I level for army is 10 days based on army's consumption rate.² 8. Supply point for Class I located near depot to serve army troops or a portion of the depot set aside for retail issue to army troops.	1. Installation: Class I supply point. XXXX 651 (Sup Pt) 2. Conventional sign: 3. Normally one per corps.³ 4. Located as far forward in corps area as possible, depending on type of operation. Should be out of heavy artillery range; on a good road net; centrally located to support all units of the corps, as much concealment as possible, army must secure corps clearance for area location. 5. Can supply corps 60,000 to 100,000. 6. Operated by one Subsistence Supply Co when handling Class I only. 7. Supply point may also be located in army area to serve army troops. 8. Levels for army supply points are established by army. Normally 2 to 3 days for units the supply point supports.	1. Regiments consolidate requirements for companies and submit consolidated requirements to division quartermaster; separate battalions consolidate for their units and submit requirements to division quartermaster; attached units submit their requirements to division quartermaster. 2. Division quartermaster consolidates Class I requirements for division and attached units and draws direct from Class I supply point based on daily ration request normally submitted 48 hours previous to time of drawing rations. 3. Division hauls from army supply point to division distributing point where rations are broken down for major units, such as regiments, separate battalions and separate companies. 4. Normally units come back to distributing point for their supplies (supply point distribution) or division quartermaster hauls to major units (unit distribution).
11 Quartermaster Class III	1. Installation: Class III depot. XXXX 620 (Dep) 2. Conventional sign: 3. Normally not more than one located in army maintenance area. Depending on method of delivery from communications zone, facilities must be available for decanting at end of pipe line; area to receive bulk in tank cars or trailers to decant from bulk to 5-gallon drums, and a storage area for 5-gallon drums or 55-gallon drums. Should be located well forward in maintenance area.	1. Installation: Class III supply point. XXXX 621 (Sup Pt) 2. Conventional sign: 3. Normally one per corps.³ 4. Location—same as for Class I. 5. Can supply corps—60,000 to 100,000 troops. 6. Operated by petroleum supply company. 7. Supply points are stocked daily by army transportation based on the days issue report. 8. Levels for army supply points are established by Army. Normally 2 to 3 days for units the supply point supports.	1. Regiments consolidate requirements for companies and send empty drums to division Class III dump and exchange empty drums for filled ones. 2. Separate battalions and attached units send empty drums to division Class III dump and exchange empty drums for filled ones. 3. Division then replaces its authorized (prescribed load) stock of filled drums by exchanging empty drums for filled ones at the supporting army Class III supply point. Where the situation is fluid division can make arrangements with army for subordinate units to draw direct from army supply points.

RESTRICTED



RESTRICTED—Security Information

1	2	3	4
Item	Army Maintenance Area	Corps Area	Unit Supply Procedure ¹
11 Quartermaster Class III (continued)	4. Operated by one petroleum depot company and one to three service companies as required. 5. Can handle Class III supplies for force 325,000 to 400,000 troops. 6. Levels are established by theater. Normally Class III level for army is 10 days, based on army's consumption rate.² 7. Supply point for Class III located near depot to serve army troops or a portion of the depot set aside for retail issue to army troops.		4. Armored divisions may prescribe the same procedure as outlined in 1, 2, and 3 above or may prescribe that separate battalions independently under combat command control go direct to army Class III supply point and exchange empty drums for full drums. (Armored division quartermaster at times establishes a mobile Class III dump). 5. Normally, any vehicle going to the rear and passing by a Class III supply point refills with gasoline before returning to the forward area.
12 Quartermaster Class II & IV	1. Installation: Quartermaster Classes II and IV depot. XXXX 600  (Dep) 2. Conventional sign. 3. Normally not more than one located in army maintenance area. Warehouses in cities and towns make the best depots. 4. Operated by one clothing and general supply depot company and two service companies. 5. Can handle Classes II and IV supplies for force 325,000 to 400,000 troops. 6. Covered storage required—90 percent. 7. Levels are established by theater. Normally, Classes II and IV level 15 days based on army's maintenance factors.² 8. Army commander allocates regulated items to subordinate units.	1. Corps units follow same procedure as for division troops except that requisitions are consolidated by battalion and submitted to army quartermaster Classes II and IV depot. 2. Corps allocates regulated items to corps troops and divisions. Requisitions for regulated items must be approved by army quartermaster based on army commander's policies.	1. Regiments consolidate requirements for Classes II and IV for companies and submit consolidated requisitions to division quartermaster. 2. Division quartermaster consolidates or assembles the requirements for the division to include attached units and submits same to quartermaster Classes II and IV depot except for regulated items which are submitted to army quartermaster. 3. The division, assigned a day of the week to pick up supplies requisitioned does so by sending division quartermaster transportation to army Classes II and IV depot or makes arrangements for units to pick up their supplies.⁴ 4. In emergency requisitions for quartermaster Classes II and IV can be submitted direct to army Classes II and IV depot by division quartermaster and picked up the same day. 5. Where conditions are not satisfactory for division to send transportation to army depot, army quartermaster can arrange to send Classes II and IV supplies to Class I supply point for designated unit.
13 Signal Classes II & IV	1. Installation: Signal Classes II and IV depot. XXXX 700  (Dep) 2. Conventional sign. 3. Normally not more than one located in maintenance area. 4. Operated by signal depot company (TO&E 11-128). 5. Can handle Classes II and IV supplies for army. 6. Covered storage required for 75–90 percent of tonnage. 7. Army units draw from signal depot based on army signal officer's approval. 8. Army level—15 days. 9. Regulated items require approval army signal officer based on army commander's policies.	1. Normally army establishes a main signal depot and operates up to three (3) forward signal dumps. 2. The corps signal battalion maintains a small stock of fast moving items that can be issued to corps troops. Normally corps units follow same procedure as for divisions except that requisitions are submitted to corps signal officer who consolidates the requisitions and submits same to army signal depot. 3. Based on army's allocation of regulated items to corps, corps allocates regulated items to corps troops and divisions. Requisitions for regulated items must be approved by the army signal officer based on the army commander's policies or priorities of issue.	1. Within regiments, requisitions are consolidated through the chain of command, and regiment submits their requirements to division signal officer; separate and attached companies and battalions consolidate their requirements and submit requisitions to division signal officer. 2. Division signal officer consolidates or assembles the requirements for the division and attached units and submits same direct to army signal depot. Regulated items require approval (army signal officer) based on army and corps commander's priorities of issue. 3. Division signal supply section picks up supplies at army signal depot or forward signal dump or makes arrangements for units to do so whenever need makes it expedient. 4. Units of the division normally pick up supplies at the division signal dump when notified such supplies have been procured. Some wire and the more common batteries are kept on hand and are available within reason, by coming for them. 5. All signal units are authorized a prescribed load of wire and fast moving items such as common batteries and radio tubes.
14 Transportation	Normally transportation has no supplies in army area. Transportation Corps items such as life preservers are stored in engineer Classes II and IV depot.		

RESTRICTED



CHAPTER 6

LOGISTICS—EVACUATION AND HOSPITALIZATION

Section I. ESTIMATE OF PATIENTS

161. Classification of Patients

a. The term *patient* includes all military personnel excused from duty because of illness, nonbattle injury, battle wound or injury, or death. For most purposes discussed in this chapter only those patients who require hospitalization or who are excused from the performance of military duty and not returned to duty within the calendar day of admission to a medical treatment facility need be considered. Patients may be classified in several ways depending upon the purpose for which such classification is made. It is important to note that not all casualties or nonbattle losses are patients.

b. In making estimates of patients or in computing hospital bed requirements, patients are usually classified by cause of disability into discuss patients, nonbattle injury patients, and battle wound or injury patients. The latter group consists of those casualties for treatment of battle wounds or injuries.

c. Patients may be classified as hospital patients, quarters patients, or similar classification depending upon the type of medical treatment facility under consideration.

d. In calculating evacuation requirements, patients may be classified by—

- (1) Severity of disability, into *walking* and *litter* patients.
- (2) Suitability for evacuation, into *transportable* and *nontransportable* patients.
- (3) Type of accommodation required for evacuation, into *recumbent* and *sitting* patients.

162. Admission Rate

The force of morbidity is usually expressed in the military services in terms of the number of admissions to medical treatment facilities (for example, to hospital, to hospital and quarters combined, etc.) per 1,000 average strength per year. The admission rate may be for all causes, for all diseases, for all nonbattle injuries or for all battle wounds or injuries. The admission rate may also be computed for specific diseases or types of injuries. For purposes of logistical estimate for planning for hospitalization requirements, the admission rate

is most conveniently expressed as a *daily admission rate to hospital* per 1,000 average strength.

Daily Admission Rate to Hospitals per 1,000 Strength—All Causes

Year	Total Army	ETO	SWP	POA
1943-----	1.9	1.1	2.4	1.7
1944-----	1.5	1.4	2.0	1.2
1945-----	1.3	1.2	2.0	1.0

163. Nonbattle Losses

a. Diseases and nonbattle injuries among front line troops of a seasoned command in campaign, except in a particularly unhealthful region, may be expected to produce a daily admission rate to medical treatment facilities (hospital and quarters combined) of about three per 1,000 per day (0.3 percent per day). This *average* rate can be expected at certain seasons of the year, without epidemics, to reach 0.5 percent or even more. As a rough rule of thumb *one-third* of these patients may be expected to remain under treatment in their own organization (at aid stations or collecting stations) or in the division clearance stations *if there is no interference with the primary mission of reception, treatment, and evacuation of casualties*. About two-thirds of the disease and nonbattle cases may be evacuated from the division area. Thus one-third of the patients are quarters cases and two-thirds of the patients are *hospital* cases.

b. The daily admission rate to hospitals, from disease and nonbattle injuries, may be shown as follows:

Daily Admission Rate to Hospitals per 1,000 Strength—Disease and Nonbattle Injury

Year	Total Army	ETO	MTD	SWP
1942-----	1.4	---	---	2.3
1943-----	1.6	1.1	1.7	2.3
1944-----	1.4	1.0	1.9	1.9

This daily admission rate to *hospital* would correspond to an admission rate to *hospital and quarters* of about 0.3 percent and *soon* would result in a constant noneffective rate of about 4.5 percent. For unseasoned troops in the same climatic conditions, the noneffective rate might reach 6 percent and would be even higher under unfavorable conditions of climate and location.

c. On the basis of experience in the Mediterranean Theater of Operations during World War II, for *nonbattle sick and injured* it may be expected that about 0.2 percent will die, 4 percent will be evacuated to the zone of interior, and the remainder, 95.8 percent, eventually will return to duty. The average stay in hospitals in a theater for nonbattle cases admitted to hospitals overseas during World War II was

about 19 days, while the total average hospitalization, including time spent in zone of interior hospitals, was about 25 days.

d. For planning purposes, certain additional estimated daily *hospital admission rates from disease and nonbattle injuries* in overseas commands during recent years are as follows:

Estimated Disease and Nonbattle Injury Hospital Admission Rate (Admissions per 1,000 Average Strength per Day)

<i>Major overseas command</i>	<i>Daily rate per 1,000</i>
Alaska.....	0.9
Austria.....	.8
Caribbean.....	1.0
Europe.....	1.0
Far East.....	1.2
Pacific.....	.9
Trieste.....	1.1

The rates shown above have been prepared to provide current data for future planning. The data have been based on Army experience over the two fiscal years from July 1950 through June 1952. It should be borne in mind, however, that these rates reflect an experience unlike that of World War II. During World War II, U. S. Army troops were engaged in combat in several major overseas areas. In the experience on which the above rates have been based, all areas were free from the effect of combat with the exception of the Far East. Because of such limitations, care should be exercised in the use and interpretation of the data shown above.

164. Casualties

a. In estimating casualties, many variable factors must be considered. These include type of troops, their location in the theater, type of engagement, enemy capabilities, etc. For this reason, it is desirable in such estimations to separate all troops in a theater into groups having approximately the same casualty rate and compute the casualties separately for each group on the basis of their numerical strength. For example, in a given theater the troops might be grouped into front-line divisions, other ground troops in the combat zone, Air Force troops, and troops in the communications zone. Each of these groups would have a different casualty rate, and the total casualties in the theater would depend upon the relative strength of each group.

b. The average daily admission rates for casualties in various theaters during World War II were as follows:

Daily Admission Rate to Hospitals per 1,000 Strength—Casualties

Year	ETO	MTO	SWP
1943		0.18	0.03
1944	¹ 0.66	0.30	0.09
1945 ²	0.47	0.18	0.33

¹ June through December.

² January through April.

c. In estimating casualties in an army, an estimate based on front-line divisions engaged usually will be more accurate than one based on a rate for corps or the army as a whole.

d. Considerable variation in casualties among Air Force troops occurs, depending upon the type of aircraft, type of mission flown, and amount of enemy air resistance. As an overall average which necessarily must be modified to apply to any special situation, casualties for all air troops can be taken as 0.2 per 1,000 per day. More commonly, casualties in Air Force troops are computed on the basis of the number of man-missions flown.

e. The number of casualties among communications zone troops, except in special situations, is negligible.

f. The ratio of killed and wounded among casualties can be estimated as follows (the figures do not include prisoners or persons missing in action):

Ratio of Killed to Wounded—World War II

Infantry:

European Theater of Operations	1:4
Mediterranean Theater of Operations	1:4
US Army Forces in Pacific	1:4
All theaters combined	1:4
Total Air Forces, all theaters	5:4
Armored, all theaters	2:7
Artillery, all theaters	1:4

- (1) In temperate and tropic zones, the overall ratio of killed to wounded may be taken as 1:4.
- (2) In the arctic zones, the ratio of killed to wounded may be considerably higher because of death of the wounded from exposure to cold.
- (3) On the basis of experience in World War II, it may be expected that about 4 percent of the wounded who reach hospitals will die; about 25 percent will be invalided home, and the remaining 71 percent will be returned to duty in the theater. Of those evacuated to the zone of interior, about 45 percent will return to duty. The average stay of

wounded personnel in oversea and zone of interior hospitals in World War II was about 94 days.

- (4) Of the wounded who reached hospitals in World War II, about 4 percent died and about—
 - 15 percent recovered in 15 days.
 - 19 percent recovered in 15 to 30 days.
 - 17 percent recovered in 30 to 60 days.
 - 11 percent recovered in 60 to 90 days.
 - 20 percent recovered after 90 days.
 - 14 percent were separated from the Army.
- (5) In World War I, it was found that of the gas casualties who reached hospitals, approximately—
 - 2 percent died.
 - 25 percent recovered in 15 days.
 - 27 percent recovered in 15 to 30 days.
 - 24 percent recovered in 30 to 60 days.
 - 16 percent recovered after 60 days.
 - 6 percent were of no further military value.
- (6) The average stay of gas casualties in oversea and zone of interior hospitals was 41.8 days.

165. Statistics

The following tables represent statistics from World War II. To be used as staff planning factors, they may require modifications, depending upon the conditions anticipated.

a. Average Daily Admission Rate per 1,000 From All Causes.

Combat conditions	Inf Div	Armd Div	Abn Div	Army	Com Z
Heavy.....	8	7	11	5	1.5
Average.....	4	4	4	3	1.5
Light.....	2	2	2	2	1.5

b. Average Daily Admission Rate per 1,000 Air Force Troops.

Location	Disease and nonbattle injury	Casualties	Total
Pacific areas ¹	2.01	0.02	2.03
European areas ²	1.87	0.27	2.14
Average active combat.....	1.80	0.20	2.00

¹ Includes Far East Air Forces, Twentieth Air Force, and China and Burma-India Air Forces.

² Includes Air Forces in European and Mediterranean Theaters of Operation.

Section II. BED REQUIREMENTS

166. General

The hospital requirements of a theater of operations are computed in terms of total beds in hospitals capable of performing definitive

treatment, not in terms of medical units. The total authorization to meet these requirements is expressed as the fixed bed allotment of the theater of operations. Medical units of the combat zone and convalescent centers of the communications zone are not included in the computation. Field hospitals are included in this allotment only when they are performing their primary mission. In general, the fixed hospital bed requirements of a theater of operations are satisfied by the assignment to the communications zone of appropriate numbers of general hospitals and station hospitals.

167. Basic Data

To compute bed requirements for any specific situation, certain basic data are necessary. These are the evacuation policy, daily admission rates, troop strengths, accumulation factor, and dispersion factor.

a. Evacuation Policy. Theater evacuation policy is a command decision made by the Department of the Army (usually upon the recommendation of the theater commander concerned). It specifies which patients will be evacuated to the zone of interior by designating a maximum number of days for the allowable period of hospitalization within the theater. Patients who, in the opinion of responsible medical officers, cannot be returned to a duty status within the period prescribed, are to be returned to the zone of interior by the first available and suitable transportation, provided the travel required will not aggravate their disabilities. The periods considered may be 30, 60, 90, 120, or 180 days. A minimum of 120 days is regarded as desirable in order to minimize the loss of trained men to the theater.

- (1) *Evacuation policies within a theater* may be established for certain areas and for certain types of medical installations, specifying which patients will be evacuated to the next higher echelon of medical care. For example, the theater commander may establish a 30-day evacuation policy for station hospitals. This would mean that all patients admitted to station hospitals whose recovery is likely to require more than 30 days would be evacuated to general hospitals. This would in no way affect the total fixed-bed requirements of the theater.
- (2) Certain flexible evacuation policies, useful as guides but varying with manpower policies, admission rates, and available beds, may be established for the combat zone. Similarly, evacuation policies for dispensaries may be specified.

b. Daily Admission Rates. See paragraph 162.

c. Accumulation Factor. Under a given evacuation policy, patients will accumulate in hospitals at a certain determinable rate, depending upon the admission rate, the type of disability, and the average period of hospitalization. Based upon experience in both world wars, these accumulation rates have been assembled into tables called *accumulation tables*. The accumulation factors given in such tables are based upon a daily admission rate of 1 per 1,000 strength and upon a specified evacuation policy. The tables below are for evacuation policies of 120, 90, 60, and 30 days. These accumulation factors take into account not only admissions to the hospital but also the various dispositions of patients from the hospitals.

(1) *Accumulation factors—120-day evacuation policy.*

	1	2	3	4	5	6	7
1	Number of days after hospitalization begins	Accumulation of patients per 1,000 strength based on admission rates of 1 per 1,000 a day each for disease and nonbattle injuries and for casualties and an evacuation policy of 120 days					
		Disease and nonbattle injuries			Casualties		
		Total	T of Opns	ZI evacuees	Total	T of Opns	ZI evacuees
2	1.....	1.00	1.00	0	1.00	1.00	0
3	5.....	4.56	4.56	0	4.81	4.81	0
4	10.....	7.64	7.64	0	9.13	9.13	0
5	20.....	11.40	11.38	.02	16.87	16.71	.16
6	30.....	13.55	13.47	.08	23.66	23.14	.52
7	60.....	17.20	16.60	.60	40.05	36.63	3.42
8	90.....	19.45	18.38	1.07	52.19	43.53	8.66
9	120.....	20.98	19.48	1.50	61.40	46.75	14.65
10	150.....	21.97	19.48	2.49	68.42	46.75	21.67
11	180.....	22.59	19.48	3.11	73.05	46.75	27.20
12	240.....	23.21	19.48	3.73	82.18	46.75	35.43
13	300.....	23.46	19.48	3.98	87.82	46.75	41.07
14	360.....	23.56	19.48	4.08	90.80	46.75	44.05
15	Over 360.....	23.65	19.48	4.17	94.22	46.75	47.47

RESTRICTED—Security Information*(2) Accumulation factors—90-day evacuation policy.*

	1	2	3	4	5	6	7
1	Number of days after hospitalization begins	Accumulation of patients per 1,000 strength based on admission rates of 1 per 1,000 a day each for disease and nonbattle injuries and for casualties and an evacuation policy of 90 days					
		Disease and nonbattle injuries			Casualties		
		Total	T of Opns	ZI evacuees	Total	T of Opns	ZI evacuees
2	1.....	1.00	1.00	0	1.00	1.00	0
3	5.....	4.56	4.56	0	4.81	4.81	0
4	10.....	7.64	7.64	0	9.13	9.13	0
5	20.....	11.40	11.38	.02	16.87	16.71	.16
6	30.....	13.55	13.47	.08	23.55	23.14	.52
7	60.....	17.20	16.60	.60	40.05	36.63	3.42
8	90.....	19.45	18.38	1.07	52.19	43.53	8.66
9	120.....	20.98	18.38	2.60	61.40	43.53	17.87
10	150.....	21.97	18.38	3.59	68.42	43.53	24.89
11	180.....	22.59	18.38	4.21	73.95	43.53	30.42
12	240.....	23.21	18.38	4.83	82.18	43.53	38.65
13	300.....	23.46	18.38	5.08	87.82	43.53	44.29
14	360.....	23.56	18.38	5.18	90.80	43.53	47.27
15	Over 360.....	23.65	18.38	5.27	94.22	43.53	50.59

(3) Accumulation factors—60-day evacuation policy.

	1	2	3	4	5	6	7
1	Number of days after hospitalization begins	Accumulation of patients per 1,000 strength based on admission rates of 1 per 1,000 a day each for disease and nonbattle injuries and for casualties and an evacuation policy of 60 days					
		Disease and nonbattle injuries			Casualties		
		Total	T of Opns	ZI evacuees	Total	T of Opns	ZI evacuees
2	1.....	1.00	1.00	0	1.00	1.00	0
3	5.....	4.56	4.56	0	4.81	4.81	0
4	10.....	7.64	7.64	0	9.13	9.13	0
5	20.....	11.40	11.38	0.02	16.87	15.71	0.16
6	30.....	13.55	13.47	0.08	23.66	23.14	0.52
7	60.....	17.20	16.60	0.60	40.05	36.63	3.42
8	90.....	19.45	16.60	2.85	52.19	36.63	15.56
9	120.....	20.98	15.60	4.38	61.40	36.63	24.77
10	150.....	21.97	15.60	5.37	68.42	36.63	31.79
11	180.....	22.59	16.60	5.99	73.95	36.63	37.32
12	240.....	23.21	16.60	6.61	82.18	36.63	45.55
13	300.....	23.46	16.60	6.86	87.82	36.63	51.19
14	360.....	23.56	16.60	6.96	90.80	35.63	54.17
15	Over 360.....	23.65	16.60	7.05	94.22	36.63	57.59

(4) *Accumulation factors—30-day evacuation policy.*

	1	2	3	4	5	6	7
1	Number of days after hospitalization begins	Accumulation of patients per 1,000 strength based on admission rates of 1 per 1,000 a day each for disease and nonbattle injuries and for casualties and an evacuation policy of 30 days					
		Disease and nonbattle injuries			Casualties		
		Total	T of Opns	ZI evacuees	Total	T of Opns	ZI evacuees
2	1.....	1.00	1.00	0	1.00	1.00	0
3	5.....	4.56	4.56	0	4.81	4.81	0
4	10.....	7.64	7.64	0	9.13	9.13	0
5	20.....	11.40	11.38	0.02	16.87	16.71	0.16
6	30.....	13.55	13.47	0.08	23.66	23.14	0.52
7	60.....	17.20	13.47	3.73	40.05	23.14	16.91
8	90.....	19.45	13.47	5.98	52.19	23.14	29.05
9	120.....	20.98	13.47	7.51	61.40	23.14	38.26
10	150.....	21.97	13.47	8.50	68.42	23.14	45.28
11	180.....	22.59	13.47	9.12	73.95	23.14	50.81
12	240.....	23.21	13.47	9.54	82.18	23.14	59.04
13	300.....	23.46	13.47	9.99	87.82	23.14	65.68
14	360.....	23.56	13.47	10.09	90.80	23.14	67.66
15	Over 360.....	23.65	13.47	10.18	94.22	23.14	71.08

d. Dispersion Factor. At any give time a certain proportion of the authorized beds for a theater will be packed for shipment within the theater. (A 20-percent factor for dispersion was generally used during WW II). This factor for dispersion is affected by the following:

- (1) The greater the mobility of the troops the greater the allowance required.
- (2) For smaller troop units operating at some distance from the main bodies of troops, it will be necessary to furnish complete hospital units even though it is realized that the troop unit will not be likely to utilize fully the hospital facilities provided.
- (3) The general practice of separate wards for patients of different sexes, cases of contagious disease, and for cases requiring different types of treatment will necessitate also a safety margin in each ward since the proportion of the various classes will vary from time to time.

168. Computations

Given these items of basic data, the fixed hospital bed requirements for a specific situation at a given time can be computed according to the following formula: (Note that an additional allowance of 25 percent is added to obtain a dispersion factor of 20 percent as defined in par. 167d.)

Example: Theater "A" has a troop strength of 500,000. Expected daily admission rates per 1,000 are as follows: disease and nonbattle injuries, 1.7; casualties, 0.6. Theater evacuation policy is to be 120 days. How many fixed hospital beds will be required at the end of 90 days?

	Rate	Accumulation factor	Troop strength thousands	Allowance for dispersion factor	
Disease and nonbattle injuries.....	1.7	$\times 18.38$	$\times 500$	$+ 25\%$	= 19,529
Casualties.....	0.6	$\times 43.53$	$\times 500$	$+ 25\%$	= 16,324
Total fixed beds required at the end of 90 days.....					35,853

169. Zone of Interior

a. Fixed beds are required in the zone of interior for those troops which do not depart for theaters of operations. When new recruits are being inducted in large numbers, morbidity tends to be rather high and beds equal in number to as much as 5 percent of the zone of interior strength may be necessary. After the period of training is over, beds equal in number to about 4 percent of the zone of interior strength may be sufficient.

b. It also is necessary to compute bed requirements for those cases evacuated from theaters of operations. These additional beds are estimated on the basis of the expected numbers of evacuees arriving in the United States (disease and nonbattle injury and casualty cases being separately considered) and the average duration of stay of such cases in zone of interior hospitals.

*Accumulation of Theater of Operations Patients in Zone of Interior Hospitals—
120-Day Evacuation Policy**

	1	2	3	4	5	6	7	8
1	Cause of admission	Daily hospital admission rate per 1,000	Accumulation of theater patients in zone of interior hospitals per 1,000 theater strength after number of days indicated following start of operations in the theater					
			60	90	120	180	360	540
2	Disease and nonbattle injury.....	1.0	0.60	1.07	1.50	3.11	4.08	4.17
3	Wounded.....	.6	2.05	5.20	8.79	16.32	26.43	28.48
4	Total patients.....		2.65	6.27	10.29	19.43	30.51	32.65
5	Increase by 25%.....		.66	1.57	2.57	4.86	7.63	8.16
6	Total beds required.....		3.31	7.84	12.86	24.29	38.14	40.81

*Based on July to December 1944 ETO admission rates.

c. To the above figures must be added an allowance, when appropriate, for care of *Navy, Air Force, allied military personnel, allied civilians, and prisoners of war*. The additional number of fixed beds for such purposes will depend upon the particular area involved, and no definite figures can be given.

d. Experience in World War II indicates that an additional allowance should be made because some patients who are to be evacuated to the zone of interior still will be in the theater after 120 days due to a change in prognosis, transportation allocation, or other reasons.

Section III. TRANSPORTATION OF CASUALTIES

170. Capacity of Transportation

1	Type of transportation	2	3	4
		Men		
		Sitting	Recumbent	Average
2	Transport airplane (C-47).....	24	24	24
3	Transport airplane (C-46).....	50	33	41
4	Transport airplane (C-54).....	49	36	42
5	Transport airplane (C-82).....	41	34	37
6	Transport airplane (C-97).....	134	83	108
7	Transport airplane (C-119).....	42	35	38
8	Transport airplane (assault, C-123).....	60	50	55
9	Transport airplane (C-124).....	200	132	166
10	Army aircraft (LC-126A).....	3	2	2
11	Army aircraft (L-19).....	1	.....	1
12	Army aircraft (L-20).....	5	2	3
13	Army aircraft (L-17).....	3	.....	3
14	Army aircraft (L-23).....	5	3	4
15	Helicopter (H-5G).....	3	2	2
16	Helicopter (H-13).....	.....	2	2
17	Helicopter (H-19).....	8	6	7
18	Helicopter (H-21).....	13	12	13
19	Helicopter (H-25).....	4	3	4
20	Ambulance, $\frac{3}{4}$ ton KD.....	8	4	6
21	Ambulance, $\frac{3}{4}$ ton, cross-country.....	8	4	6
22	Truck, $\frac{1}{4}$ ton.....	2	2	2
23	Truck, $\frac{3}{4}$ ton.....	8	5	6
24	Truck, $1\frac{1}{2}$ ton.....	10	10	10
25	Truck, $2\frac{1}{2}$ ton.....	16	18	17
26	Truck, $2\frac{1}{2}$ ton, amphibian.....	12	12	12
27	Railway car, coach.....	88	.....	88
28	Pullman car, 12 section.....	48	24	36
29	Pullman car, 16 section.....	64	32	48
30	Hospital train.....	¹ 240	240	240
31	LVT.....	12	6	9
32	LCVP.....	36	² 17	26
33	LCM.....	60	15	37
34	LST.....	³ 180	⁴ 120	300
35	Bus, motor, 37 passenger, convertible.....	37	18	28

¹ Maximum for overnight journey.

² Only 7 litters if LCVP is to be hoisted aboard for loading.

³ In addition to recumbent patients.

⁴ In addition to sitting patients.

171. Time Element of Evacuation

Following are factors for evacuation of personnel (including loading and unloading):

a. Litter Squads.

- (1) Average terrain, 4-man squad—1,000 yards and return in 1 hour.
- (2) Mountainous terrain, 6-man squad—400 yards and return in 1 hour.

b. Ambulance, Motor, During Combat, in Division Area. Five miles and return in 1 hour.

c. Aircraft.

- (1) Helicopter—50 miles *one way* in 1 hour.
- (2) Transport airplane—100 miles *one way* in 1 hour.
- (3) Army aircraft—75 miles *one way* in 1 hour.

172. Ambulance Requirements

Ambulance requirements for a continental land mass are as follows:

a. By army to clear automatically the division clearing stations:

Per infantry division, 15 ambulances.

Per armored divisions, 30 ambulances.

b. By corps for corps troops, 20 ambulances.

c. By army for army service area, 30 ambulances.

d. By advance section, communications zone, to clear army evacuation hospitals it is supporting, 10 ambulances per hospital (400- or 750-bed).

Section IV. ANIMALS**173. General**

Noneffective rates and evacuation and hospital requirements for animals vary greatly with the age, type, and condition of the animals, and the nature and location of the operation in which they are engaged.

174. Noneffective Rate

The noneffective rate of horses and mules between the ages of 6 and 15 years, and of dogs between the ages of 2 and 5 years will be lower than for animals in younger or older age groups. It will be notably lower in trained and seasoned animals, and it will be normally lower in temperate zones than in the tropics. Availability and use of proper rations, water, shelter, and rest periods also are important factors. The noneffective rate will be unduly high where untrained, incompetent, or poorly supervised personnel are employed. About 45 percent of all horses and mules and about 20 percent of all dogs (at war dog reception and training centers only) admitted to sick report

during World War II required hospitalization. The noneffective rate per 1,000 strength during World War II was as follows:

Area	Horses			Mules		
	Disease	Injury	Total	Disease	Injury	Total
Entire Army 1942-1945.....	19	23	42	15	17	32
Zone of interior 1942.....	15	25	40	12	14	26
MTO, 1944.....	94	64	158	30	44	74
CBI, 1944.....	55	55	110	19	20	39

This chart covers periods of approximate peak strength or activities. Animals in the Mediterranean Theater of Operations were engaged in active operations over 50 percent of the period and in China-Burma-India over 25 percent.

175. Evacuation Policy

a. The system of evacuation of animal casualties closely parallels that of personnel casualties, except that evacuation from a theater of operations to the zone of interior is not contemplated and those which are incurably sick or wounded are destroyed as soon as detected.

b. The evacuation policy is established by the theater commander and is predicated on a combination of two principles—first, that tactical units be relieved of animal casualties adequately to allow such units to maintain necessary mobility; second, that no animal be evacuated farther than is necessary in the best interests of the patient's recovery. Those requiring short periods of hospitalization usually are evacuated to a veterinary field hospital or comparable unit in the service area at once. Those requiring longer periods usually are evacuated to a veterinary general hospital or comparable unit in the communications zone. In line with this policy, forward units in the chain of evacuation are utilized to their fullest capacity commensurate with the situation.

176. Length of Hospitalization

The average period of treatment for horses and mules requiring hospitalization during World War II was 27 days. The average for war dogs was 20 days. This does not include quarantine periods.

177. Hospital Stall Requirements

Hospital stall requirements per 1,000 strength will approximate the following:

	1	2	3	4
1		In active theaters	In the zone of interior	
			Seasoned	Unseasoned
2	Pack animals (horses and/or mules)	150	35	100
3	Dogs.....	60	35	60

178. Evacuation Requirements and Capacities

a. Requirements. Estimates for ambulance requirements are based upon the anticipated hospitalization rate, evacuation policy, and length of the evacuation chain. Normally, all animals are evacuated by motor (ambulance or truck). Rail transportation may be used where practical. Animals may be evacuated by walking, but because of the adverse effects on the patient, this practice should be avoided except for short distances.

b. Means and capacities.

<i>Means of evacuation</i>	<i>Capacity, pack animal (horse or mule)</i>
Trailer, 2-horse, van	2
Truck, 1½-ton, cargo	2
Truck, 2½-ton, cargo*	4
Semi-trailer, 6-ton, combination animal and cargo ..	8
Railroad stock car, 40-ft	25 (approx.)
Railroad stock car, 36-ft	20-22 (approx.)
Veterinary lead line (walking)	20
Airplane, transport (C-47)	4 or 6
Airplane, transport (C-119)	15 (approx.)
Airplane, transport (C-124)	40 (approx.)

*The 2½-ton cargo truck equipped with standard body with or without modifications (preferably with stock rack) will hold four animals and usually is the most efficient means of evacuating seasoned animals over difficult terrain.

179. Veterinary Units

a. Evacuation units are the Veterinary Evacuation Detachments, teams ID and IE (T/O & E 8-500).

b. The service unit is the Veterinary Animal Service Detachment, team IC (T/O & E 8-500).

c. Hospital units are the Veterinary General Hospital (T/O & E 8-750), the Veterinary Field Hospital (T/O & E 8-780), and the Veterinary Hospital Detachments, teams IA and IB (T/O & E 8-500)

CHAPTER 7

LOGISTICS—TRANSPORTATION

Section I. GENERAL

180. Chapter Contents

Transportation data and methods of computing transportation requirements are presented in 11 sections as follows:

- Section I. General.
- II. Pipelines.
- III. Inland waterways.
- IV. Railways.
- V. Movement of troop units by rail.
- VI. Highway transport.
- VII. Helicopters.
- VIII. Miscellaneous transport modes.
- IX. Terminals.
- X. Transport aircraft.
- XI. Ocean transport.

181. Transportation Estimates and Plans

a. Transportation estimates and plans are necessarily dependent upon the user of transportation, whose firm requirements are often not available until after tactical plans and supply service plans have been completed. In order for transportation planners to plan concurrently with other staff agencies, it is often necessary for them to adopt methods of utilizing troop strength and requirement factors that will permit a reasonable estimate of transportation requirements in broad terms, to be defined at a later date in terms of class and service (or item) of supplies and categories of personnel or troop units.

b. Transportation planning usually progresses in the following steps:

- (1) The first step in transportation planning is to survey existing and potential facilities for movement of troops and supplies.
- (2) Based upon a study of these facilities, select the means of movement most efficient under the conditions.
- (3) Plan to use the more efficient means as far forward as practicable, and with a minimum waste of effort in rehandling cargo.
- (4) In addition to the principles of military economy, the transportation plan in the forward area must provide for tactical flexibility. The desired flexibility usually is supplied by

highway trucks working from the forward end of rail, water, and pipeline facilities. Supply by air may be used to supplement or replace other means.

182. Capacities of Lines of Communications

a. The capacities of lines of communications are quantitative statements of the ability of the lines to transport cargo or troops, and are usually expressed in tons (long or short) or troops per day. Frequently, troops per day may be equated to tons per day to provide a common unit of measure. A ton-mile is the actual forward movement of one ton one mile.

b. Capacities are dependent upon the following:

- (1) Density of movement, which is dependent upon the physical character of the way (waterway, railway, highway, airway, etc.) and its terminals.
- (2) Number and lift capacities of available transportation mediums.
- (3) Turn-around time (time required for a complete cycle of movement), which is dependent upon speed of transport mediums; speed of loading and unloading; and time consumed in maintenance, miscellaneous delays, and operation en route.
- (4) Efficiency of management and maintenance organization.

c. Capacities may be calculated by the following formulas for the cases stated below:

- (1) *Case I.* Where the number of transport mediums available is sufficient to achieve maximum density (saturate the way)—
Daily capacity = lift capacity of single medium $\times$ density of movement per day.
- (2) *Case II.* Where number of transport mediums is limited (less than sufficient to achieve maximum density)—
Daily capacity = (number of operational transport mediums $\times$ lift capacity of single medium) $\div$ turn-around time in days.

d. Efficiency of management is an intangible factor, which may enter arithmetical calculations of capacity only by experience or estimate. Such efficiency is dependent on number and skill of operating personnel, degree of intelligent movement planning, and effectiveness of operating technique.

183. Advance Transportation Planning Factors

When it is desirable to obtain an estimate of transportation requirements well in advance of detailed planning, the following general averages may be used:

a. Cargo Ships.

Capacity----- 5,600 short tons of Army cargo.*
 Discharge rate----- 720 short tons per day discharging alongside berth.
 Discharge rate----- 720 short tons per day discharging in stream.
 Beach capacity----- 1,680 short tons per 1,000 yards of beach.
 Amph trk capacity----- 720 short tons per amphibious truck company per day.

*See par. 240n.

b. Shipping Requirements for an Assault Division Slice of 25,000 Men.

Type	Extended voyage (10 days)	Short voyage (2-3 days)
AGC (Amphibious Forces Flagship)-----	1	-----
APA (Transport, attack)-----	15	9
AKA (Cargo ship, attack)-----	7	6
LST (Landing ship, tank)-----	22	36
LSM (Landing ship, medium)-----	14	12
LSD (Landing ship, dock)-----	7	3
LCU (Landing ship, utility)-----	32	-----

c. Percentage of Organizations and Supply Moved in Assault or Cargo Craft in Amphibious Operations. Supply as used below refers to accompanying supply. After the assault phase, supply is by cargo shipping only, except for emergency supply. Percentages are as follows (to be used only when assault lift is not known):

- (1) Eighty percent of the total personnel moved in assault naval shipping.
- (2) Twenty percent of the total personnel moved in cargo type shipping.
- (3) Sixty percent of the organizational equipment and supplies for units moved in assault naval shipping will accompany the units transported in that shipping.
- (4) Forty percent of the organizational equipment and supplies for units moved in assault naval shipping will be transported in cargo type shipping.
- (5) Due to space or other factors, it sometimes is not possible to move all of the organizational equipment and supplies of a unit on the same ship. These supplies and equipment in such case may be moved on another ship of the same convoy providing sufficient personnel from the parent unit accompany them.

*d. Railways (Foreign Countries).**(1) Standard gage.*

Single track----- 4,000 short tons per day each way (will support about two corps).
 Double track---- 12,000 short tons per day each way (will support an army of about 18 divisions).
 Train load----- 400 short tons of cargo (33 cars at about 12 tons) or 1,000 troops (40 boxcars at 25 troops each).

(2) Narrow gage (39½- and 42-inch).

Single track----- 2,000 short tons per day, net, each way.
 Train load----- 200 short tons per day, net, or 500 troops.

e. Highways:

- (1) A 500 T/D road is a single-lane all-weather road capable of sustained traffic in one direction with 25 percent of the distance available for passing.
- (2) A 1,000 T/D road is a double-lane all-weather road capable of sustained traffic but with 50 percent of the distance limited to one-way traffic.
- (3) A 2,000 T/D road is a double-lane all-weather road capable of sustained two-way traffic and having two-way bridging.
- (4) A hard surfaced, two-lane road of intermediate macadam or equivalent will support a corps of *four* or *five* divisions.
- (5) Trucks required to move the foot troops of an infantry division—255 vehicles, equivalent to about 6 transportation truck companies, in addition to all organic division vehicles.
- (6) A transportation truck company equipped with 2½-ton 6 x 6 trucks can move 150 tons per day over a forward distance of 75 miles and return to the starting point (150-mile total).

f. Pipelines. A 6-inch pipeline will transport 2,246 short tons of petroleum products per day and will support three corps (par. 184).

g. Air Transport. To transport the initial echelon of an infantry division by air requires 662 C-119 or C-123 type aircraft. Sufficient personnel, weapons, and vehicles are included so that the infantry division can operate with the same degree of combat effectiveness as the assault echelon of an airborne division. For detailed aircraft requirements, see paragraph 56.

Section II. PIPELINES

184. Capacity

The capacity of a pipeline system varies with the length, gradient, and condition of the lines and with the power and efficiency of the pumps. For planning purposes, the following capacities may be used:

	1	2	3
1	Pipe diameter	Gallons per day	Net short tons per day (motor gas)
2	4-inch.....	288,000	883
3	6-inch.....	660,000	2,246
4	8-inch.....	1,670,000	5,123

185. Capability

Generally, a 6-inch pipeline can maintain 3 corps, totaling not more than 12 divisions. (For construction materials and operating unit requirements, see sec. II, ch. 8.)

Section III. INLAND WATERWAYS

186. General

a. Types. Inland waterways include all navigable inland waters such as rivers, lakes, inland channels, and canals of sufficient depth to accommodate cargo traffic. The following are the general types into which inland waterways are grouped:

- (1) Lakes.
- (2) Rivers.
- (3) Ship canals.
- (4) Barge canals.
- (5) Intracoastal waterways.

b. Characteristics. The characteristics of a waterway which must be considered in an analysis of its capabilities are as follows:

- (1) Restricting widths and depths of channel.
- (2) Vertical and horizontal bridge clearance.
- (3) Location of dams and other bars to navigation.
- (4) Location of locks, dimensions, and timing.
- (5) Seasonal floods and droughts, their frequency and duration.
- (6) Normal freeze-up and opening dates.
- (7) Hazards to navigation such as rapids and falls.
- (8) Speed and fluctuation of current.
- (9) Waterway maintenance requirements.
- (10) Changes of channel.

187. Waterway Capacity Estimates

a. Limiting Factors. Factors, other than waterway characteristics, having a limiting effect on waterway capacity are—

- (1) Availability of suitable barges or craft.
- (2) Availability of suitable operating personnel.
- (3) Availability and adequacy of terminals and terminal facilities.

b. Turn-Around Time. This factor is defined as the time required for a barge or craft to load, travel to destination, unload, return to origin, and be ready to resume loading. It has considerable effect on waterway capacity and involves—

- (1) Length of haul, taken as round trip distance.
- (2) Speed in still water—4 miles per hour.
- (3) Speed and direction of current.
- (4) Loading and unloading time—computed at 8.4 short tons per barge per hour.
- (5) Time consumed in locks.
- (6) Operating hours per day—normally taken as 20, allocating the remaining 4 for maintenance, refueling, restoring, etc.

c. Capacity Determination, Craft Available to Fill or Exceed Waterway Capacity. When sufficient barges or craft are available to fill or exceed waterway capacity, the daily tonnage that may be moved over the waterway is equal to one-half the number of craft per day that can be passed through the most limiting constriction (example, a lock, lift bridge, narrow channel, etc.) times the average net capability of the craft in use.

d. Capacity Determination, Craft Not Available to Fill or Exceed Waterway Capacity. The following formula may be used to determine the number of tons a given number of barges can transport a given distance daily:

$$\frac{\text{Number of barges} \times \text{tons per barge} \times \text{hours of operation per day}}{\text{Turn-around time in hours}} = \text{tons moved daily}$$

Example: Determine the daily tonnage 20 barges of 270 short tons capacity each can move 60 miles forward with no lost time in locks and negligible effect due to current.

$$\text{Travel time per barge} = \frac{60 + 60}{4} = 30 \text{ hours}$$

$$\text{Loading and unloading time per barge} = \frac{2 \times 270}{8.4} = 64.3 \text{ hours}$$

$$\text{Turn-around time per barge} = 30 + 64.3 = 94.3 \text{ hours}$$

$$\frac{20 \text{ barges} \times 270 \text{ tons per barge} \times 20 \text{ hours}}{\text{daily availability}} = 1,145.3 \text{ short tons daily}$$

$$\frac{1,145.3 \text{ short tons daily}}{94.3 \text{ hours turn-around time}}$$

188. Floating Equipment Requirements

a. *Cargo Craft.* To determine the number of barges or cargo craft required to move a given tonnage a given distance forward daily, use the following formula:

$$\frac{\text{Daily tonnage} \times \text{hours turn-around time}}{\text{Tons per barge} \times \text{hours of operation daily}} = \text{Number barges required}$$

Example: Determine the number of barges having a capacity of 500 short tons required to move 1,000 short tons daily a distance of 100 miles forward, assuming no lost time in locks and negligible effect due to current.

$$\text{Travel time per barge} = \frac{100 + 100}{4} = 50 \text{ hours}$$

$$\text{Loading and unloading time per barge} = \frac{2 \times 500}{8.4} = 119 \text{ hours}$$

$$\text{Turn-around time per barge} = 50 + 119 = 169 \text{ hours}$$

$$\frac{1,000 \text{ tons daily} \times 169 \text{ hours}}{\text{turn-around}} = 16.9 \text{ barges} = 17 \text{ barges required}$$

$$\frac{500 \text{ tons per barge} \times 20 \text{ hours}}{\text{daily operation}}$$

b. *Tugs and Towboats.* Since a single tug or towboat can normally be used to tow more than one barge, and loading time is not a consideration in tug or towboat availability, it follows that fewer tugs than barges will be required in any given situation. To determine the number of tugs or towboats required to efficiently operate a given number of barges in a given situation, use the following formula:

$$\text{Number of tugs} = \frac{\text{Total number of barges} \times \text{turn-around time for tugs in days}}{\text{Number of barges per tow} \times \text{turn-around time for barges in days}}$$

Example: Determine the number of tugs required to operate 400 barges, where each tow consists of 5 barges, turn-around time for barges is 4 days, and turn-around time for tugs is 2 days.

$$\frac{400 \text{ barges} \times 2 \text{ days tug turn-around}}{5 \text{ barges per tow} \times 4 \text{ days barge turn-around}} = 40 \text{ tugs required}$$

Section IV. RAILWAYS

189. General

Railway construction data are contained in chapter 8.

a. Estimates of railway capacity, operating personnel, equipment, and supply requirements for a specific railway line should take into consideration the basic characteristics of the line, the nature of the country in which the operation is planned, and the purpose for which the planning is being done. The following items are considered essential to intelligent appraisal. If these are not available, their effects upon the operation must be assumed, based on overall information of railroad operations within the country involved.

- (1) Length of line.
- (2) Condition of roadbed and track.
- (3) Gage of track.*
- (4) Single, double, or multiple track.
- (5) Weight of rail.
- (6) Type of ballast and depth.
- (7) Type of ties (if wood, treated or untreated).
- (8) Tie spacing.
- (9) Axle load limitations (track and bridge).
- (10) Profile of line showing location and length of ruling grade.
- (11) Alinement of line showing location and length of minimum radius curves.
- (12) Location and description of bridges and tunnels.
- (13) Location and length of passing tracks.
- (14) Location, type and quantity of fuel supply.
- (15) Location, quantity and quality of water supply.
- (16) Location and capacity of yards.
- (17) Location and capacity of car repair shops, and enginehouses.
- (18) Type and availability of motive power.
 - (a) Weight in working order.
 - (b) Expected working tractive effort.
 - (c) Age.
- (19) Type and availability of rolling stock.
 - (a) Capacity and dimension.
 - (b) Age.
- (20) Allowable draw-bar pull.

*Track gages vary widely starting at 1 foot 11½ inches and going to 5 feet 6 inches. The most widely used gages are—

Broad	Standard	Narrow
5 ft. 6 in.-----	-----	2 ft. 6 in.
5 ft. 3 in.-----	4 ft. 8½ in.-----	3 ft. 3¾ in.
5 ft. 0 in.-----	-----	3 ft. 0 in.

- (21) Diagrams showing minimum structure, maximum unrestricted loading and equipment gages.
- (22) Signal system.
- (23) Dispatching facilities.
- (24) Route junctions.
- (25) Availability of new equipment and spare parts.
- (26) Indigenous labor resources.

b. A military railway operating division will vary from approximately 90 to 150 miles depending upon existing conditions. For general planning purposes, however, an average of 120 miles per railway division may be assumed.

190. Evaluation and Planning

Paragraphs 191 through 199 are designed primarily for wartime estimates of railway operations in a theater of operations. Analytical refinements and elaborate train density studies are difficult to justify and have been avoided because of the lack of basic information and the relative uncertainty inherent in military operations. The planner should also bear in mind that in the early stages of a war, indigenous equipment and labor may be utilized to a large extent which again may vary the expected tonnage capacity.

191. Train Density

Train density is the number of trains per day which can be operated in each direction over a railway line. Work trains are not included in train density. Train densities will vary, depending upon the condition of track, location and length of passing sidings, adequacy of terminal facilities, and availability of motive power and rolling stock. Densities recommended below are averages based on experience under theater of operations conditions. After air superiority has been attained, the intensity of combat has been reduced, and dependent upon judgment of operating conditions, densities achieved may be expected to exceed by 20 percent those presented below. (For planning capacities, see par. 183*d*.)

Single track lines*-----	10 trains per day in each direction.
Double track lines-----	30 trains per day in each direction.
Multiple track lines-----	The extra tracks will be used to rehabilitate and maintain two tracks in operation under most theater of operation conditions.

*Passing track intervals of 8 to 10 miles.

192. Net Train Load

The net train load, or pay load, carried by trains on different divisions of the same line may vary greatly, depending upon the conditions of operation. Experience indicates that, under normal theater of operations conditions over standard gage railways, a net train load of 400 short tons may be used as an *average* for general planning purposes. On narrow gage railways, a net train load of 300 short tons may be used.

193. Net Division Tonnage

a. Net division tonnage is the net tonnage (short tons) or pay load which can be moved over a railway division each day.

Formula:

Net division tonnage = (train density) $\times$ (average net train load)

b. Troop, hospital, or other special trains will replace an equal number of tonnage trains and, when operation of such trains is anticipated, the factor for train density must be so adjusted with the resulting decrease in net division tonnage.

c. When employing coal burning motive power, a further reduction must be made in the pay load to compensate for the necessary fuel and supplies required to operate the railroad. This reduction may be estimated at 5 percent of the net load for each division after the first in its relation to the source of fuel and supplies. The use of diesel motive power will reduce this operating factor to such an extent that it may be disregarded in this portion of the planning.

194. Equipment Estimation

Planning data included herein are based on use of standard United States Transportation Corps equipment. Allowances for use of indigenous or captured equipment should be based on judgment after evaluation of the many factors involved, such as availability of equipment, extent of expected destruction, condition of equipment, types and local availability of fuel, availability of spare parts, types of coupling devices, etc. Data are available in logistic surveys, special transportation studies based on intelligence reports, reports of governments or railroads in peacetime, and from articles appearing in such publications as *Railway Gazette* (British) and *Railway Age* (United States).

a. *Road Engines.* The following data are recommended for general planning purposes. Computation of requirements should be made for each division separately.

Average rate of travel from division terminal to division terminal—10 miles per hour.

Time in each division terminal for steam locomotives—8 hours.*

Time in each division terminal for diesel-electric locomotives—3 hours.*

Reserve engines, to allow for unforeseen circumstances such as operational peaks, heavy repairs, or destruction—20 percent.

Formula:

$$\text{Number required for division} = TD \times \frac{RT + TT}{24} \times 2 \times RF,$$

where

TD=train density, one way.

RT=average running time in hours.

TT=terminal time at one end of the division.

24=number of hours in a day.

RF=operational reserve factor=1.20.

b. Switch Engines.

- (1) Switch engine requirements at port terminals, division terminals, railheads, and depots are dependent on the physical track layout and the number of cars required to be handled at such points. The following may be used as a general guide only.

Location	Switch engines required†
Port terminals or base of operations.	1 per 67 cars dispatched and received per day.
Division terminals.....	1 per 100 cars passing per day.
Railhead classification.....	1 per 67 cars dispatched and received per day.
Depots.....	1 per 50 cars dispatched and received per day.

† Either steam-powered or diesel-electric..

- (2) Requirements computed as above should be increased by 20 percent to allow for unforeseen circumstances, repairs, etc.

*Allows time for locomotive servicing, running repairs, and time lost between enginehouse and yards.

c. *Rolling Stock.*(1) *Freight.*

- (a) Requirements are computed separately for operations between major supply installations or areas on each LOC as follows:

$$\text{Number of cars} = \frac{\text{daily tonnage}}{\text{average tons per car}} \times \text{turnaround time}$$

Turnaround time is the total estimated number of days required for a car from the time it is placed for loading at its point of origin, moved to its destination, unloaded, and returned to its point of origin. Such time may be computed as follows: allow 2 days at origin, 2 days at destination, and 2 days transit time for each division (or major portion thereof) which the cars must traverse. This method, rather than an actual hour basis, is used to incorporate delays due to terminal and way station switching as well as in-transit rehandling of trains.

- (b) Computations should be increased by 10 percent to meet operational peaks, commitments for certain classes of cars, and bad order cars.
- (c) An average planning factor for net load per car may be assumed as follows:

<i>Standard gage</i>	
U. S. equipment-----	22 tons.
Foreign equipment-----	12 tons.

<i>Narrow gage</i>	
U. S. equipment-----	16½ tons.
Foreign equipment-----	7½ tons.

- (d) Tank car requirements are computed separately based on the bulk POL requirement and the computed turnaround time.
- (2) *Passenger.*
- (a) Passenger car requirements will vary, depending upon troop movement policies, evacuation policies, and rest and recuperation policies.
- (b) Theater passenger car requirements are normally fulfilled by acquisition of local equipment, with the exception of hospital cars or trains.

195. Characteristics of U. S. Rolling Stock

Type of car	Gage (inch)	Capacity			Tare weight (empty) (tons)	Inside dimensions		
		Cubic feet	Tons	Load limit (tons)		Length	Width	Height
Box (30 ton).....	36	1,484	30	33	-----	34'5½"	7'¾"	6'1¾"
	39¾							
	42							
Box (40 ton).....	56½	2,345	40	44	-----	40'6"	8'6"	6'9¾"
	60							
	63							
Flat (30 ton).....	66	-----	30	33	-----	34'8½"	7'2"	-----
	36							
	39¾							
Flat (40 ton).....	42	-----	40	44	-----	40'8"	8'7¼"	-----
	56½							
	60							
Flat (80 ton).....	63	-----	80	88	-----	46'8"	10'1"	-----
	66							
	56½							
Flat, depressed center (60 ton).	60	-----	60	66	-----	-----	-----	-----
	63							
	66							
Gondola, high side (30 ton).	56½	-----	30	33	-----	34'5"	6'10½"	4'
	36							
	39¾							
Gondola, high side (40 ton).	42	-----	40	44	-----	40'5½"	8'3¾"	4'
	56½							
	60							
Gondola, low side (30 ton).	63	-----	30	33	-----	34'6"	6'11½"	1'6"
	36							
	39¾							
Gondola, low side (40 ton).	42	-----	40	44	-----	40'4½"	8'3¼"	1'6"
	56½							
	60							
Tank, POL (5,000 gal.)	63	687	5,000 gal.	30	-----	Outside 31'6"	Diam. tank 5'3¼"	-----
	36							
	39¾							
Tank, POL (10,000 gal.)	42	1,367	10,000 gal.	40	-----	Outside 38'5½"	Diam. tank 6'8¾"	-----
	56½							
	60							
Refrigerator (30 ton)....	63	836	30	33	-----	28'10"	6'	4'10"
	36							
	42							
Refrigerator (40 ton)....	39¾	1,477	40	44	-----	34'	7'½"	6'2"
	56½							
	60							
	63							
	66							

Note.—Average pay load of each type of car, except tank cars, is 55 percent.

196. Outsize Equipment

Outsize equipment is that equipment which, because of extreme dimensions (height, width, length) or extreme weight or combinations of the above, will require special handling under restricted speeds and/or on special cars. The planner should recognize the fact that more and more of this type of equipment is being designed and should attempt to build a train of these outsize loads for a single movement rather than assume a few in each train moving on the LOC. Such movements require special meeting points on adjacent lines of a double track LOC and will retard traffic returning to its point of origin as well as following trains in the same direction.

197. Personnel Requirements

The basic unit of railway organization in a theater of operations, as in the United States, is the railway division. Military organizations of administrative and operating personnel are designed to fulfill the operating personnel needs of the basic units (railway divisions) and the administrative personnel needs of the several divisions comprising a system of railways. Personnel requirements are therefore estimated by division.

198. Administrative and Operating Organizations

- a. *Administrative.* The following organizations are administrative: Headquarters and headquarters company, transportation military railway command (T/O & E 55-302). Normal requirement: one per two or more railway groups.

Headquarters and headquarters company, transportation military railway group (T/O & E 55-202). Normal requirement: one per two to six transportation railway operating battalions and one or two transportation railway shop battalions.

b. *Operating.*

- (1) *Transportation railway operating battalion.*

- (a) Requirements are estimated on the basis of the number of train crews required. The 50 train crews provided in the one transportation company of the battalion became the controlling factor. Where augmentation is necessary, additional crews are provided by T/O & E 55-500, Transportation Corps Service Organization. This augmentation does not upset the equilibrium of the battalion for carrying out its assigned function, provided the normal length of line to be operated (90 to 150 miles) is not exceeded or motive power added exceeding the capabilities of Company B for equipment maintenance. Normally, one

railway operating battalion is assigned to one railway division.

(b) In estimating train crew requirements, the following basis may be used:

1. *For road operations.* One crew per train per day (moving in either direction) per division.
2. *For switching.* Two crews per switch engine in operation. (For general planning purposes, reserve switch engines are not considered.)
3. *For road operations and switching.* Assume 80 percent availability of assigned crews to allow for sickness and other absences.

(2) *Transportation railway shop battalion.* Under normal requirements one shop battalion may be expected to support depot maintenance for 100 steam locomotives, 200 diesel-electric locomotives, and 2,500 cars or actual depot maintenance for 10 steam locomotives, 25 diesel-electric locomotives and 600 cars. Exact requirement should be tempered by judgment and the overall railway plan for the theater.

199. Supply

a. *Fuel and Lubricants.* (See sec. IV, class III, Supply, ch. 5.)

b. *Spare Parts.* Estimated spare parts requirements for motive power and rolling stock: 1.5 short tons per month for each train per day (moving in either direction) over each division.

Section V. MOVEMENT OF TROOP UNITS BY RAIL

200. Space Requirements for Troop Loading on United States Equipment

For planning purposes and staff training, the following assumptions may be used:

a. *Sleeping Cars, Average.* Thirty-two troops with individual equipment (including standard Pullmans, tourist Pullmans, and troop sleepers).

- (1) Officers and warrant officers will be moved in standard Pullmans, two per section. They should be listed in number of sections (example: 14 officers, show as 7 sections) as officers and warrant officers of all units in one train will be grouped in one or more Pullman cars as required.
- (2) Enlisted men will be moved in tourist Pullmans, three per section. Noncommissioned officers of the first three grades are entitled to a separate berth. Allowances should be made for personnel attached from medical battalions and personnel detached for guards on freight cars.

b. Coaches, Average. Fifty-five troops with individual equipment.

c. Passenger Trains (typical for long distance troop moves). Eleven sleeping cars, two kitchen cars, and one or two baggage cars—average 350 troop per train.

d. Freight Trains. For troop unit moves, including heavy equipment such as tanks, artillery, and engineer equipment; trains seldom exceed—

Infantry divisions—65 cars or 650 tons.

Armored divisions—55 cars or 1,200 tons.

e. Mixed Trains. Mixed trains which carry all the personnel with their vehicles, artillery, and equipment are desirable from a tactical and organizational standpoint. Such moves are not economical when passenger equipment is in short supply, as mixed trains move at freight speed. In mixed trains, box cars may be substituted for baggage cars.

201. Loading of Organizational Equipment

a. The amount of headquarters, kitchen, and maintenance equipment varies somewhat in all units. For planning purposes, allow 20 short tons per company or equivalent unit.

b. Organizational equipment moves under freight rates and normally will be loaded in unit transportation. If loaded separately, additional box cars will be required. Checkable baggage up to 150 pounds per individual is carried free. Normally, this will be loaded in baggage or box car. When transportation groupings permit, checkable baggage for two companies or similar units may be loaded in one box car.

202. Kitchen-Baggage and Flat Cars

a. Kitchen-baggage and kitchen cars are furnished on the basis of one per 250 men or fraction thereof. Kitchen-baggage car requirements per train are dependent upon transportation groupings. For tentative estimates, allow one per unit.

b. Compute flat cars (or drop-end gondolas) required on basis of maximum utilization of each car, regardless of length. Do not restrict computation to cars of all one length. Twelve inches at one end of each car must be left for brake-wheel clearance. For detailed approved methods of loading vehicles and equipment, see Association of American Railroads booklet, "Rules Governing the Loading of Mechanized and Motorized Army Equipment"; also, "Major Caliber Guns for the United States Army and Navy, on Open Top Equipment."

203. Recommended Loading of Typical Vehicles and Equipment

1	1	2	3
	Equipment	Rail car	Units per car
2	Tank, light, M24.....	40 ft flat	2
3	Tank, medium, M4A3 and similar types.....	42 ft flat	2
4	Tank, medium, M45 and tank, heavy, M26.....	40 ft flat	1
5	Truck, ¼-ton.....	50 ft flat	8
6	Truck, ¾-ton, weapons carrier.....	42 ft flat	3
7	Truck, 2½-ton, cargo LWB.....	50 ft flat	2
8	Truck, 2½-ton, cargo SWB.....	50 ft flat	2
9	Truck, 4-ton, wrecker.....	40 ft flat	1
10	Truck, 10-ton, wrecker.....	40 ft flat	1
11	Truck, trailer, tank transporter, 45-ton.....	40 ft flat	1
12	Truck, tractor, 6-ton.....	40 ft flat	2
13	Vehicle, tank recovery, M32.....	42 ft flat	2
14	Vehicle, utility, armored, M44 (or equivalent).....	42 ft flat	2
15	Carriage, motor, M19.....	50 ft flat	2
16	Carriage, motor, multiple gun, M16.....	50 ft flat	2
17	Howitzer, 105-mm.....	40 ft flat	2
18	Howitzer, 155-mm.....	40 ft flat	1

204. Infantry Division and Armored Division Rail Moves

The following tables show samples of various combinations of rail equipment that could be used to move infantry and armored divisions. The specific types of equipment to be used and the detailed make-up of each train must be worked out between the unit transportation officer and the local railroad representative.

a. Infantry Division. Eighteen thousand troops—17,000 tons (vehicles and major equipment).

1	1	2	3	4	5
	Types of loading	Passenger equipment			Cars (F)
		Sleepers (S)	Kitchen (K)	Baggage (B)	
2	Separate loading:				
	51 passenger trains (11S 2K 2B).....	561	102	102	-----
	26 freight trains, 65 cars each (655 tons per train).....				1,680
	77 trains.....Totals.....cars.....	561	102	102	1,690
3	Mixed trains:				
	4 trains (6S 1K 38F).....	24	4	-----	152
	60 trains (9S 2K 28F).....	540	120	-----	1,680
	64 trains.....Totals.....cars.....	564	124	-----	1,832
4	Combination move:				
	26 passenger trains (11S 2K 2B).....	286	52	52	-----
	46 mixed trains (6S 1K 38F).....	276	46	-----	1,748
	72 trains.....Totals.....cars.....	562	98	52	1,748

b. Armored Division. Fifteen thousand troops—31,000 tons (vehicles and major equipment).

	1	2	3	4	5
	Types of loading	Passenger equipment			Cars (F)
		Sleepers (S)	Kitchen (K)	Baggage (B)	
1					
2	Separate loading:				
	43 passenger trains (11S 2K 2B).....	473	86	86	
	26 freight trains, 52 cars each (1,190 tons per train).....				1,352
	69 trains.....Totals.....cars.....	473	86	86	1,352
3	Mixed trains:				
	67 mixed trains (7S 1K 21F).....	469	67		1,407
4	Combination move:				
	11 passenger trains (11S 2K 2B).....	121	22	22	
	50 mixed trains (7S 1K 28F).....	350	50		1,400
	61 trains.....Totals.....cars.....	471	72	22	1,400

205. Weight of Tracked Vehicles

The tracked and half-tracked vehicles of the divisions, with their towed loads, make up approximately the following tonnages:

Infantry division..... 10,000 tons
 Armored division,..... 24,000 tons

(In theater of operation and for mixed trains in the United States, the crews and other troops which normally travel in or on the tracked vehicles usually will ride on the same train.)

206. Movement of Troop Units on Foreign Railways

a. The capacity of railroads and railway equipment fluctuates widely throughout the nations of the world. Experience in Europe during World War II indicates that under the pressure of all-out war, there are few, if any, places in the world where complete troop units can be moved by rail at the same time that the rail net is supplying a major force. A compromise policy was developed in which tracked vehicles and foot troops were moved by rail whenever facilities were available and wheeled vehicles with their normal towed loads proceeded on highways.

b. Assumed Capacity of Foreign Rail Facilities.

(1) *Freight cars:*

War flats..... 50 tons.
 Medium flat cars..... 25 tons.
 Small flat cars..... 12 tons.
 Box cars..... 10 tons or 25 troops.

(2) *Passenger:*

Coaches*----- 40 troops.
 Sleeping cars*----- 32 troops.

*In the forward areas, passenger equipment is seldom used for unit moves. The limited amount of available equipment may be used for movement of casualties, convalescents, redeployment groups, or leave trains

(3) *Trains (foreign):*

Maximum length----- 40 cars.
 Maximum net load----- 400 tons.
 Maximum troops 1,000 (using box cars).

207. Troop Movement Planning

a. Scales. In training and preparation for movement, all units will become familiar with the use of railway car loading scales (par. 208) or equivalent scales, tables, or templates.

b. Rail Movement Table. To attain a condition of readiness for movement of rail, each troop unit will prepare and maintain up-to-date a rail movement table (par. 209). The same data in a slightly different form can be used for the unit personnel and tonnage table in preparation for movement by water.

c. Types of Tables. When the rail movement has been ordered and the approximate types of equipment requested, the following tables must be prepared by each unit:

Train consist table (par. 210).

Entraining table (par. 211).

Individual train-loading plan (par. 212).

d. Alert Time—(Zone of Interior.) An alert is not an order and rail carriers do not move equipment into position for loading on an alert. It requires 48 hours after receipt of orders by the Chief of Transportation to start loading a division, assuming that no equipment is available at the installation.

e. Loading Time—(Zone of Interior.) Passenger trains require 1 hour for loading. Baggage cars for personal baggage and baggage cars used for kitchen purposes will be spotted in advance. The time required to load troop units with all vehicles and equipment on freight trains or mixed trains varies with the training status of the unit and the conditions at the loading point. Use 6 hours for planning.

F T	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
I N	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240	252	264	276	288	300	312	324	336	348

30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
360	372	384	396	408	420	432	444	456	468	480	492	504	516	528	540	552	564	576	588	600

RAILWAY
CAR LOADING
SCALE ($\frac{1}{4}''=1'$)

(Cut out and paste in
a large sheet for use)

Inches			
109 ¼-ton trailer			
133 ¾-ton truck			
146 1-ton trailer			
177 ¾-ton weapons carrier w/winch			
225 1½-ton truck 6x6 w/winch			
239 M4A4 medium tank			
265 2½-ton truck LWB, w/winch			

VEHICLE AND EQUIPMENT
LOADING SCALE (¼ in.=1 ft.)
Lengths and widths shown are
for illustration only.

² Scale No. 2 is constructed on the same basis ($\frac{1}{4}$ inch equals 1 foot) and is specially

scaled to indicate the shipping lengths of various types of vehicles and equipment assigned to a given unit. By applying scale 2 to scale 1, various combinations may easily be developed which will result in the maximum utilization of railway equipment.

209. Rail Movement Table (Sample)

INFANTRY DIVISION 1234

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Line No.	T/O & E	Unit	Strength		Or- gan- iza- tional equip- ment	Check- able bag- gage	Vehicles and equipment per unit													Railway car requirements per unit										
							Standard vehicles								Special equip- ment	Passenger					Freight									
			Trailers		Trucks						Items	Shipping length inches	Coach	Pullman		Kitchen baggage	Organizational equip- ment	Checkable baggage	Box		Flat cars									
			Off & WO	EM	Pieces	Weight	Pieces	Weight	1/4-ton 56" W 109" L	1-ton 146"			1/4-ton 4 x 4 62" W 133" L	1/4-ton 4 x 4 Comd 166"	1/4-ton 4 x 4 wpns carr w/winch 177"				1 1/2-ton 6 x 6 w/winch 225"	2 1/2-ton LWB w/winch 256"	2 1/2-ton LWB w/winch 265"	2 1/2-ton SWB w/winch 245"	48 men	Std No. of Sees (2 sec)	Tour No. of Sees (3 sec)	40'	42'	45'	50'	
1	7-1	Div hq.....																												
2	7-2	Hq co inf div * (incl band).....																												
3	17-57	Ren co.....																												
4	19-27	MP co.....																												
5	9-25	Ord maint bn.....																												
6	10-17	QM co.....																												
7	11-7	Sig co.....																												
8	20-7	Repl co.....																												
9	7-12	Inf regt, hq & hq co *																												
10	7-13	Inf regt, sv co.....																												
11	7-14	Inf regt, hv mort co.....																												
12	17-37	Inf regt, hv tk co.....																												
13	8-7	Inf regt, med co.....																												
14	7-16	Inf bn, hq & hq co.....																												
15	7-17	Inf r co.....																												
16	7-18	Inf hv wpns co.....																												
17	6-101A	Div arty hq & hq btry *																												
18	6-126	L arty bn hq & hq btry *																												
19	6-127	L arty btry (105-mm how)																												

RESTRICTED

363

RESTRICTED—Security Information

209

INFANTRY DIVISION 1234

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Line No.	T/O & E	Unit	Strength		Organizational equipment	Checkable baggage	Vehicles and equipment per unit													Railway car requirements per unit										
							Standard vehicles										Special equipment	Passenger		Freight										
			Trailers				Trucks								Coach	Pullman			Box		Flat cars									
			Off & WO	EM			Pieces	Weight	Pieces	Weight	1½-ton 56" W 109" L	1-ton 146"	¾-ton 4 x 4 62" W 133" L	¾-ton 4 x 4 Comd 166"	¾-ton 4 x 4 w plus cart w/winch 177"	1½-ton 6 x 6 w/winch 225"		2½-ton LWB w/winch 258"	2½-ton LWB w/winch 283"	2½-ton SWB w/winch 245"	Items	Shipping length inches	48 men	Std No. of Secs (2 sec)	Tour No. of Secs (3 sec)	Kitchen baggage	Organizational	Checkable baggage	40'	42'	45'	50'
20	6-129	L arty sv htry (105-mm how).																												
21	6-136	M arty hn hq & hq htry ¹																												
22	6-137	M arty htry (155-mm how).																												
23	6-139	M arty sv htry (155-mm how).																												
24	44-76	Aaa aw hn hq & hq htry																												
25	44-77	Aaa aw htry																												
26	5-16	Engr hq, hq & sv co ²																												
27	5-17	Engr co																												
28	8-16	Med bn hq & hq co																												
29	8-17	Med amh co																												
30	8-18	Med clr co																												
31	17-36	Tk hn, hq & hq & sv co																												
32	17-37	Tk co																												

¹ Can be adapted to any type unit.² This tentative table should be maintained currently by division transportation officers in compliance with paragraph 12, AR 55-130. Subordinate and separate units should maintain similar tables.³ Upon receipt of movement order, the table will be revised to reflect actual strength and equipment on hand and to conform to provisions of the movement order.⁴ Organizational equipment and checkable baggage must be listed separately.⁵ Includes attached medical and chaplains.

210. Train Consist Table

DIVISION

Train No.	Transportation groupings	Railway equipment							Train officers
		Coach	Pullman		Kitchen or kitchen-baggage	Box	Flat and gondola	Total	
			Standard	Tourist					
1.....									CO..... Mess O..... Surg.....
2.....									CO..... Mess O..... Surg.....
3.....									CO.....

NOTES

1. Upon receipt of movement order commanding general will designate the order in which units will be forwarded.

2. Train consist table is prepared by division transportation officer from data appearing on revised rail movement table.

3. Maximum and minimum length of trains (total number of freight and passen-

ger cars) will be prescribed by the origin railroad (par. 1, AR 55-145).

4. Under "transportation groupings" show units which will comprise each individual train.

5. Under "train officers" show by name the officers assigned to each train in accordance with paragraphs 14, 15, and 16, AR 55-145.

RESTRICTED

365

RESTRICTED—Security Information

210

212. Individual Train-Loading Plan

DIVISION

Train No.-----

Main No.-----

**ASSIGNMENT OF PERSONNEL AND EQUIPMENT
TO INDIVIDUAL RAILWAY CARS**

Front

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	Continue to last car				rear

SUGGESTED SYMBOLS FOR EQUIPMENT AND VEHICLES

Equipment	Sym- bol	Equipment	Sym- bol	Equipment	Sym- bol	Equipment	Sym- bol
Coach.....	CH	Box.....	BX	Gun, 37-mm, AT..	GAT		
Pullman, standard..	SP	Truck, ¼-ton....	TJ	Howitzer, 105-mm..	HL		
Pullman, tourist....	TP	Traller, ¼-ton....	TQ	Howitzer, 155-mm..	HM		
Troop sleeper.....	TS	Truck, 2½-ton....	TO				
Kitchen car.....	K	Motorcycle.....	MO				
Kitchen-baggage....	KB						

ASSIGNMENT OF UNITS TO CARS (BY BLOCK NUMBERS ABOVE)

Unit	Block Nos.	Unit	Block Nos.	Unit	Block Nos.

NOTES

1. This plan is prepared by the division transportation officer. Copies should be furnished to:
 - a. Troop commanders.
 - b. Entraining officers.
 - c. Train commanders.
 - d. Motor park dispatcher so that vehicles will arrive at entraining point in the order in which they will be loaded on railway cars.
 - e. Local transportation officer.
2. In each block, indicate by symbol the specific personnel and equipment assigned to each car.
3. In each block representing an open-top freight car (flat car or gondola car) indicate by symbol the equipment specifically assigned to each car.
4. In the space provided at the bottom of the plan, all cars (freight and passenger) should be assigned by block numbers (not by railroad car initials and numbers) to the specific units, which will occupy them.

Section VI. HIGHWAY TRANSPORT

213. Definitions, as Applied to Highway Transport Operations

- a. *Line of Communications (LOC) Haul.* A type of haul where the distance is such that the proportion of running time is high in relation to the time consumed in loading and unloading. Usually expressed in terms of ton-miles forward per day.
- b. *Local Haul.* A type of haul where the proportion of time consumed in loading and unloading is high in relation to running time. Usually expressed in terms of tons forward per day. Beach and port clearance hauls are local hauls involving the movement of cargo arriving at ports and beaches from ships, landing craft, or amphibious vehicles to inland dumps, depots, supply points, or railheads.
- c. *Average Vehicle Availability.* The average number of task vehicles per company available for continuous operation.
- d. *Rate of March.* Average marching speed in miles per hour, including short periodic halts.
- e. *Operating Time.* Number of operational hours per day.

214. Planning Factors

- a. In estimating truck company requirements for advance planning, the following basic facts must be considered:
 - (1) Amount and type of cargo to be hauled daily.
 - (2) Average pay load per vehicle.
 - (3) Vehicle availability.
 - (4) Distance cargo is to be hauled.
 - (5) Average rate of movement.
 - (6) Loading and unloading time.
 - (7) Operating time.
 - (8) Highway capabilities.
- b. In the absence of specific information, the following values may be assumed for advance planning factors:

Factors	Type of equipment	
	2½-ton 6 x 6 trucks	10-ton semitrailer
Average pay load (highway use).....	4 tons.....	8 tons.
Vehicle availability.....	36 per co.....	36 per co.
Average rate of movement (allowing for rests, halts, refueling, etc.).	10 mi in hr.....	10 mi in hr.
Loading and unloading time (the total elapsed time between arrival and departure from loading or unloading point).	2½ hours.....	2½ hours.
Operating time (2-shift).....	20 hours.....	20 hours.
Average one-way distance of local hauls (includes port and beach clearance, intradepot moves, etc.).	10 miles.....	10 miles.

215. Truck Company Requirements

a. Having determined or assumed values for the above factors, the truck company requirements for any type of sustained operation may be estimated by the use of the following formula:

$$\text{companies required} = \frac{\text{daily tonnage} \times \text{operating turn-around}}{\text{payload} \times \text{availability} \times \text{operating day}}$$

In the above formula "operating turn-around" is computed as follows:

$$\text{operating turn-around} = \frac{\text{round trip mileage}}{\text{rate of movement}} + \text{loading and unloading time}$$

(If the number of trucks is desired instead of the number of truck companies, omit the "availability" factor in the basic formula.)

b. If it is desired to determine the number of truck companies required to move a given tonnage of cargo in one lift, the method of computation is:

$$\text{companies required} = \frac{\text{total tonnage}}{\text{payload} \times \text{availability}}$$

(Again, if the number of trucks is desired instead of truck companies, omit the "availability" factor from the formula.)

c. Examples—(Using planning factors given in paragraphs 220 and 223).

- (1) Estimate the number of truck companies required for a 16-mile haul of 5,000 short tons of dry cargo daily, using 2½-ton, 6 x 6, trucks.

$$\text{operating turn-around: } \frac{32}{10} + 2.5 = 5.7 \text{ hours}$$

$$\text{requirements: } \frac{5,000 \times 5.7}{4 \times 45 \times 20} = 8 \text{ companies}$$

- (2) Estimate the number of truck companies required to haul 3,000 short tons per day of dry cargo 180 miles, using 10-ton semitrailers.

$$\text{operating turn-around: } \frac{360}{10} + 2.5 = 38.5 \text{ hours}$$

$$\text{requirements: } \frac{3,000 \times 38.5}{8 \times 45 \times 20} = 16 \text{ companies}$$

- (3) Estimate the number of 2½-ton, 6 x 6, trucks required to haul 700 tons in one lift.

$$\text{requirements: } \frac{700}{4} = 175 \text{ trucks}$$

(The above formulas may be used to compute requirements for hauling bulk liquid by substituting daily gallons for daily tonnage and payload in gallons instead of short tons.)

216. Evaluation of Planning Factors

Consideration must be given in all cases to conditions which may affect highway transport operations, and each planning factor must be evaluated accordingly.

a. Average vehicle payloads will vary with the type and condition or equipment, the condition of highways and terrain over which vehicles will operate, and the type and density of cargo.

b. Availability will vary with the condition of equipment, adequacy of maintenance facilities, proficiency of personnel, and supply of spare parts and replacements.

c. Average rate of movement will vary with the type and condition of equipment, the condition and maintenance of highways (including the cumulative effect of bridges, fords, steep grades, sharp curves, tunnels, and other restrictions to traffic), and extent of other traffic on roads. Allowances must be made in estimating rate of movement for rests, halts, refueling, etc.

d. Loading and unloading time will vary with the number and proficiency of laborers, availability and adequacy of materials handling equipment and facilities, and with the type of equipment utilized, and the size, bulk, or type of cargo.

e. Operating time, for sustained operations, is normally based on two shifts of 10 hours each, which allows time for daily driver or unit maintenance and service. Where conditions require other than a 20-hour operating schedule, proper substitution in the basic formula will reflect the truck company requirements.

f. All of the above mentioned factors may be affected individually or collectively by other considerations, such as:

- (1) Seasonal and climatic conditions.
- (2) Enemy interference, or other tactical conditions.
- (3) Other traffic, including tactical, administrative, and indigenous vehicles; and foot troops and refugees.

217. Vehicle Payload Capacities

Type of equipment	Off-road	Highway average (see par. 2200)	Maximum	Men and equipment*
Truck, cargo, ¼-ton, 4 x 4.....	¼-ton.....	¼-ton.....	¼-ton.....	3
Automobile, light, 5 passenger.....				5
Truck, pickup, 1-ton, 4 x 4.....	¼-ton.....	1-ton.....	2-ton.....	9
Truck, cargo, 2½-ton, 6 x 6, M35.....	2½-ton.....	4-ton.....	5-ton.....	20
Truck, 5-ton, 4 x 2, S & P.....		5-ton.....	7½-ton.....	**33
Truck, 10-ton, 6 x 4, S & P.....		10-ton.....	12½-ton.....	**35
Bus, convertible, 37 passenger.....		5-ton.....	5-ton.....	37
Semitrailer, 10-ton, 26' S & P.....		8-ton.....	10-ton.....	**51
Semitrailer, van, 10-ton, 26'.....		8-ton.....	10-ton.....	**50
Semitrailer, 20-ton, 34' S & P.....		18-ton.....	20-ton.....	**67
Semitrailer, van, 20-ton, 34'.....		18-ton.....	20-ton.....	**66
Semitrailer, 12½-ton, 40' C2.....		12½-ton.....	12½-ton.....	
Semitrailer, 25-ton, lowbed.....		20-ton.....	25-ton.....	
Semitrailer, 60-ton, lowbed.....		40-ton.....	60-ton.....	
Semitrailer, 5,000 gal. gas tank.....		5,000 gals.....	5,000 gals.....	
Semitrailer, refrigerator, 7½-ton, lgt wgt.....		7½-ton.....	7½-ton.....	

*Does not include driver or assistant.

**Recommended for emergency use only.

218. Highway Tonnage Capacities

a. In selecting the routes over which cargo is to be hauled, consideration must be given to the ability of the roads and bridges to sustain the operation. The gross weight of the heaviest loaded vehicle should not exceed the rated tonnage capacity of the weakest bridge, unless it is determined that such bridge or bridges will be strengthened. It is difficult to determine the exact tonnage capabilities of highways for sustained operations because of the number of varying conditions which prevail. Also, the volume of tactical, administrative, and indigenous traffic to be accommodated on supply routes may exceed the number of cargo hauling vehicles, which further restricts the capabilities of highway transport.

b. The following table may be used as a guide in estimating the tonnage capabilities of highways under average conditions, assuming operations are sustained, adequate road maintenance is provided, and each road bears two-way traffic.

Highway type	Short tons per day
Unimproved.....	200
Gravel.....	1, 000
Soil bound gravel or stone base, bituminous treated.....	2, 500
Bituminous surfaced macadam.....	4, 000
High type asphaltic or concrete pavement.....	8, 000

Note.—The above capabilities may be exceeded up to 50 percent for other than sustained operations; however, the surface or pavement may be damaged to the extent that heavy maintenance will be required before sustained operations may be resumed.

c. Planned tonnage movement should not exceed the capability of any portion of the road net to be used, unless reconstruction or heavy maintenance is provided to increase the capability of the section of highway or bridge to meet the demands. Otherwise, alternate routes must be selected to distribute the load. If no alternate route is available and the indicated tonnage is not reduced, the highway or bridge can be expected to deteriorate rapidly and disrupt any sustained operation. (It should be kept in mind that maintenance vehicles and personnel on a road may also interfere with the flow of traffic and thereby limit capability.)

219. Division Trains

In the forward area, it is normal to assume that roads are rough; therefore, in planning, trucks carry their rated loads only. When divisional trucks are used over good roads or in supply missions in the rear of the division zone, loads not to exceed 5 tons total for a 2½-ton truck, with or without trailer, may be used. Division trucks are not organized and equipped for continuous round-the-clock hauling; when they are called upon for limited 24-hour-per-day operation, it is essential that extra drivers and supervision be furnished. Use the availability indicated in paragraph 215.

220. Armored Division Trains

a. Each combat battalion of the armored division has sufficient trucks in its unit trains to support the battalion for a distance of about 35 miles from army supply points or other source of supply. The actual distance capability in any operation depends upon conditions of the roads and vehicles and the ability of the enemy to interfere with friendly supply movements.

b. In addition to the unit trains, the quartermaster battalion contains six truck platoons, equivalent to two transportation truck companies. These vehicles, in addition to their usual class I, II, and IV supply missions, may be used to extend the reach of the entire division by bringing up gasoline and ammunition from army supply points to the division trains' area, where unit trains can pick up their loads. The exact distance which these division trains can accomplish depends upon the daily tonnage requirements; an average situation would provide an effective forward move of 25 to 30 miles.

221. Infantry Division Trains

a: The unit trains of infantry and field artillery elements of the infantry division do not have sufficient vehicles to be self-supporting except when supplies are available close to the division zone. Armored elements of the infantry division have organic truck support similar to that outlined in paragraph 220. All elements of the division are capable of transporting their loads of ammunition for limited operations.

b. The division quartermaster company contains the same number of general cargo trucks as a transportation truck company. These trucks are used to bring up rations and class II and IV supplies. They also maintain a supply of gasoline to assist those elements of the division which do not have organic fuel and lubricant trucks. The ammunition trains of all combat elements need help from the quartermaster trucks whenever expenditures are heavy.

c. By a combination of unit trains and division trains, the infantry division can support itself at an average distance of about 35 to 40 miles from army supply points.

Section VII. HELICOPTERS**222. General**

Cargo helicopters are employed to move cargo and personnel short distances within forward areas of combat zones. They are limited in speed and range as compared to other types of aircraft; however, their ability to land and take off vertically makes them ideal for operation in and out of small unprepared areas. They are also able to fly low and to fly slowly, thus permitting continued operation under weather conditions which would ground other aircraft. Normal missions of cargo helicopters are movement of critical supplies and equipment to combat units, tactical displacement of troops, and missions involving transportation to areas inaccessible to other means of transport.

Although the helicopter is capable of vertical ascent and descent with limited loads, its capabilities are considerably greater where a short take-off or landing run is possible. The lift capability of the helicopter is greatly dependent upon air density as affected by altitude and temperature.

223. Helicopter Characteristics and Capabilities

Aircraft		Over-all dimensions				Cargo door		Floor above ground	Cargo compartment						Fuel			
Model	Crew	Fuselage length	Width	Height (over- all)	Rotor diameter	Dimen- sions	Loca- tion		Length	Width	Depth	Troop seats	Lit- ter capa- city	Cargo space (cubic feet)	Tank capa- city (nor- mal opns) (gal- lons)	Aver- age con- sump- tion per hour (gal- lons)	Maxi- mum endur- ance ¹ (hours of fuel)	Maxi- mum range ¹ (NM)
H-19	1	41' 8½"	11'	13'4"	53'-----	48" x 48"	Right	2'	10'	5'6"	6'	10	6	340	100	35	3.2	202
H-21C	2	52'6"	14'6"	18'	2 3 blade, 44'	60" x 45"	Left	4'	20'	5'6"	5'6"	22	12	610	300	53	5.5	435
H-25A	1	32'	8'10"	12'6"	2 3 blade, 35'	28" x 48"	Left	2'	8'3"	48" to 54"	4'8"	4	3	160	100	32	3.1	220

¹ Based on normal fuel load and operating at cruising speed.

Aircraft speed ¹ (knots)			Weights							Rescue hoist capacity ²
Model	Maximum	Cruising	Empty (dry) (pounds)	Gross (pounds)	Maximum allowable gross weight at sea level (pounds)	Weight of crew, oil and trapped fuel (pounds)	Useful load (pounds)	Payload at normal gross weight (pounds)	Maximum weight of external cargo load (pounds) ³	
H-19	97	78	4,895	6,764	7,500	256	1,869	1,613	1,800	1 person.
H-21C	99	92	8,839	13,256	14,500	616	4,417	3,801	4,500	1 person.
H-25A	94	71	3,894	5,750	6,100	436	1,556	1,120	1,500	1 person.

¹ Rescue hoist equipment to be installed on 1 out of every 5 aircraft, and are not to be used as cargo hoists.² Design capacity only.³ Speed figures are based upon no wind condition.

224. Planning Factors

a. Availability. Two-thirds of assigned helicopters are normally available for daily operations. The remaining one-third are undergoing periodic inspection or major maintenance.

b. Hours of Operation. Helicopters operate 4 hours per 24-hour day. Twenty hours per day are required for terminal service.

c. Loading or Unloading Time.

Personnel (including casualties)—10 minutes.

Cargo (in fuselage)—5 minutes.

Cargo (suspended beneath helicopter)—3 minutes.

d. Operating Speed. The number of statute miles a helicopter will travel in an hour is equal to normal cruising speed less 15 miles per hour. This allows for reduction in speed prior to landing and immediately after take-off.

Section VIII. MISCELLANEOUS TRANSPORT MODES**225. General**

There are other modes of transportation which are relatively less important than pipeline, water, rail, highway, and air transportation in the overall picture of transportation, but all have peculiar characteristics which are adaptable to special situations as indicated in paragraphs 226-229. For this reason, planners should not underestimate their value.

226. Cableways and Tramways

Type	Employment	Maximum length (feet)	Capacity each (pounds)	Speed
Engineer medium cableway.	Transports material and personnel over a single ravine, gorge, or gully-----	1,200-----	3,000-----	550 feet per minute.
Engineer light aerial tramway, M2.	Transports material and personnel over slopes up to 35° from the horizontal and spans streams and ravines that lie across its route.	3,000-----	350-----	400 feet per minute.
Engineer light pioneer aerial tramway and cableway, M1.	Transports material and personnel over terrain inaccessible or difficult for other means of transportation. Can be used as a cableway to cross a single ravine, gorge, or gully; as a tramway to traverse slopes up to 35° from the horizontal; or as a toboggan hauling unit for operation on snow or smooth ground.	Tramway, 2,000; cableway, 1,500.	Tramway, 350; cableway and toboggan, 2,000.	Tramway, 310 feet per minute; cable- way and toboggan, 580 feet per minute.

227. Pack Animals (Mule)

a. Employment. Pack mules may be employed to transport light cargo over terrain which is impassable for motor transport.

b. Capabilities.

- (1) Capacity—200-250 pounds.
- (2) Movement of casualties—1 litter or 2 sitting casualties.
- (3) Rate of march—2 to 3½ miles per hour.
- (4) Average daily distance:
Mountainous terrain—15 miles per day.
Rolling or flat terrain—20 miles per day.
- (5) Gradeability:
Rate of ascent—1,650 vertical feet per hour.
Rate of descent—1,000 vertical feet per hour.
- (6) Noneffective rate—32 per 1,000 mules.

228. Sled Trains

a. General. The mission of the sled train is to furnish over-snow transportation for supplies and equipment in support of operations where ordinary methods of transportation are impracticable.

b. Planning Factors.

- (1) Composition of sled trains—for planning purposes the ideal load for tractors, based upon their drawbar horsepower, allowing sufficient reserve power is as follows:

Class ^a	Loaded 10-ton sleds	Wan- gan ^b
91-140.....	6	1
61-90 ^c	4	1
46-60.....	3	1
36-45 ^d	2	1

^a Indicates drawbar horsepower.

^b Shelter on sled for crew.

^c Tractors in the 61-90 class can pull 4 sleds over rough terrain, 6 sleds over level terrain, and 8 or 10 sleds on level ice 30 inches thick. Up to 12 sleds can be pulled by this class if starting assistance is provided.

^d Tractors in the 36-45 class can pull 6 loaded sleds on level ice, but the assistance of another tractor is required to start the load.

- (2) Lift capacity, sled, cargo, 10-ton:
Average—9 short tons. Maximum—12 short tons.
- (3) Miles per day (20-hour operation)—40.

229. Human Bearers

a. General. Human bearers consist of natives or other personnel used for the transportation of personnel and/or supplies. Their use is generally limited to those situations where other modes are impractical or not available.

b. Planning Data. For planning purposes, the following may be assumed:

- (1) *Cargo loads.*
 - (a) Male bearers—40 pounds average load.
 - (b) Female bearers—30-35 pounds average load.
- (2) Personnel loads—8-12 bearers per litter team (for continuous operation).
- (3) Rate of march—15 miles per day under average conditions.
- (4) Noneffective rate—approximately 30 percent.

Section IX. TERMINALS

230. General

a. Types. A terminal is either end of a carrier line, such as a railroad, trucking line, shipping line, or air line. It normally includes servicing, repair, and maintenance facilities; classification yards; dock and lighterage facilities; management offices; storage facilities; and freight and passenger loading and unloading facilities as required. The four types of terminals treated in this section are:

- (1) Ports.
- (2) Beaches.
- (3) Inland terminals.
- (4) Aerial ports.

b. Elements of Terminal Planning. There are normally five steps in terminal planning:

- (1) *Step 1.* Computation of the terminal work load required to support the operation, expressed as cargo tonnage and number of personnel per day.
- (2) *Step 2.* Estimation of the existing terminal capacity, which is the total tonnage and personnel that can be *received, processed, and cleared* through the terminal in a day.
- (3) *Step 3.* Estimation of construction requirements, which are the requirements for repair and rehabilitation of existing facilities and construction of new facilities necessary to increase the existing terminal capacity to equal the required terminal work load.
- (4) *Step 4.* Estimation of the equipment requirement, which is the amount of equipment needed to process the required work load through the terminal with the maximum efficiency.
- (5) *Step 5.* Estimation of the personnel requirements, which are the units and individuals needed for administration and operation in processing the required work load through the terminal.

231. Ports

a. General. This paragraph deals with planning data for ports in the hands of the enemy, but which are to be opened for operation as soon as cleared. For this reason, data are based on the employment of Army personnel and ships' gear only for the unloading of ships. Appropriate allowances should be made for other circumstances such as availability of civilian labor and port cranes. Ship discharge will be accomplished by one of two methods—either from vessels alongside a wharf onto the wharf, or by lighters from a vessel anchored astream. Throughout the discussion of ports in this paragraph, the basic period of time is a 20-hour day. This is generally considered to be a complete round-the-clock working day in port operations, the other 4 hours of the day being taken up in delays inherent in the work such as breakdowns, waiting for trucks, changing shifts, and meals. (For planning of port discharge in forward areas when enemy action may be expected to cause work delays, 15 hours working time per day may be estimated. Factors used may be reduced proportionately.) For general planning purposes, the transportation port company is considered capable of discharging 720 short tons per 20-hour working day.

b. Port Capacity Estimation.

- (1) *Factors.* Port through-put capacity is determined by three major factors. In all instances, one of these will be the limiting and thereby determining factor. Each of the three factors may be expressed in terms of short tons per day for planning and estimating purposes. All three factors should be accurately estimated even though the limiting factor may be obvious. These estimates will serve to indicate the facilities where improvement effort will yield the greatest return in terms of tonnage movement capability. The three major factors are:
 - (a) The ability to move ships into the harbor or coastal area of the port, that is, port reception capacity.
 - (b) The ability to accommodate ships in the harbor and to discharge them, that is, port discharge capacity.
 - (c) The ability to accomplish port clearance, that is, port clearance capacity.
- (2) *Checklist for port capacity estimation.*

*Collect and evaluate these data**Compute these factors**Determine this figure*

1. Channel depths-----
2. Obstructions-----
3. Enemy air activity---
4. Enemy surface activity.
5. Enemy submarine activity.
6. Climate-----
7. Weather-----
8. Mine fields or contaminated areas.
9. Our own capabilities in combating obstacles.

(a) Evaluate to determine: A. Port reception capacity.

1. Tactical dispersion requirements.
2. Wharf facilities-----
3. Beach capabilities---
4. Discharge rates ashore.
5. Discharge rates astream.
6. Anchorage area-----
7. Extent of destruction or contamination.
8. Climate and seasons.
9. Weather and tide characteristics.
10. Cargo-handling equipment available.
11. Floating craft and equipment available.
12. Transit sheds and areas.
13. Availability of indigenous labor.
14. Space reserved for local economy.
15. Enemy activity-----

(b) Evaluate to determine: B. Port discharge (input) capacity.

Port throughput capacity.

1. Capacity of rail facilities.
2. Capacity of highway facilities.
3. Capacity of inland waterway facilities.
4. Capacity of pipeline facilities.
5. Capacity of air facilities.
6. Enemy activity-----

(c) Add to determine: C. Port clearance (output) capacity.

- (a) These data will probably be obtained from Navy sources; also see paragraphs 240 through 249.
- (b) For information on beaches see paragraphs 213 through 221.
- (c) Capabilities of transport services—pipeline, inland waterway, rail, highway, air transport—are shown in sections II, III, IV, VI, and X, chapter 7 respectively.

c. Wharf Facilities.

- (1) *General.* Since only two methods of ship discharge are available (*a* above), general planning must consider wharf facilities for alongside and lighter discharge. The Victory type ship having five hatches is used as a basis for all discharge. It was selected since it so closely meets the average characteristics of a nominal ship. Deep-draft wharfage must be provided wherever *alongside* discharge is contemplated. Shallow draft wharfage and anchorage areas must be given joint consideration when lighter discharge is contemplated. Factors governing wharfage will be found in (2) and (3) below.
- (2) *Deep-draft wharf requirements.* A wharf is classified as deep-draft when the water alongside is deep enough to permit a fully loaded ship to tie up alongside. The following criteria will govern:
 - (a) *Water depth.* Water depth should be not less than 30 feet at low tide. A minimum of 30 feet is used for planning purposes since this will accommodate virtually all deep-draft vessels.
 - (b) *Length for Victory type ship, 500-feet.* Each hatch (five per vessel) will require 100 feet of wharf. When wharfs are over 500 feet long and less than the next higher 500-foot unit, the odd footage is disregarded in determining the number of berths available (that is, 1,200 feet will accommodate only two ships at the same time). However, the extra 200 feet can be considered for lighterage use ((3) below).
 - (c) *Width.* Width should be 60 to 90 feet for discharge on one side of wharf only; 90 feet and up for discharge on both sides of wharf. For planning and estimating purposes, a wharf should be 60 to 90 feet wide to allow sufficient working space to discharge cargo from a ship. In the case of a pier where two vessels can tie up at the same time, one on each side, it is recommended that the width be 90 feet or more for efficient discharge.

(3) *Lighterage wharf requirements.*

- (a) *General.* Any wharf may be used for lighter discharge. It may include wharfage that dries out at low tide but which can be used half the time or 10 hours per day.
- (b) *Length for lighter.* Wharfage length for a lighter should be 100 feet. Length of wharfage over 100 feet and less than the next higher 100-foot unit is disregarded (that is, a 350-foot wharf will handle three lighters at the same time).
- (c) *Width.* A minimum of 35 feet is recommended for discharge on one side—42 feet for discharge on both sides of pier.

d. *Discharge Rates.*

- (1) *From ship (Victory type).* Seven hundred and twenty short tons per 20-hour day (five hatches at 7.2 short tons per hour).
- (2) *From lighter alongside, direct onto wharf.* One hundred and eighty short tons per 20-hour day (1.8 short tons per linear foot of wharf per 20-hour day).

e. *Anchorage Areas.* Anchorage areas are defined as shelter areas inside or near a harbor, unaffected by swell, where ships may anchor and discharge by lighter.

- (1) *Depth.* Minimum, 30 feet; maximum 210 feet. The minimum depth is dictated by the draft of the ship, and the maximum by the length and weight of the anchor chain.
- (2) *Free swinging anchorage area.* Eight-hundred-foot-radius circle.
- (3) *Moored bow and stern.* Variable; this method is not preferred since it can be used only in areas unaffected by tidal currents.

f. *Estimation of Port Operating Personnel and Equipment.*

- (1) *General.* To insure maximum efficiency in port operations, a balanced operating force of general and special service units, supervisory elements, and suitable equipment must be available. Extreme care must be exercised during both the planning phase and actual operating phase to insure that a balance is established and maintained. The possibility of using civilian and prisoner-of-war labor should not be overlooked, particularly in later expansion of the port.
- (2) *Operating personnel.* Operating personnel are divided into managing, or supervisory, elements (such as port headquarters units) and functional general and special service operating units. In this last category may be included port companies or battalions, general service companies, truck companies, engineer general and special service units, harbor craft units, and such other service units particularly suited

for the functioning of any particular port. Units commonly found in a port are listed below:

- Headquarters and Headquarters Company, Transportation Major Port (Port Headquarters) (T/O & E 55-110-1).
- Headquarters and Headquarters Company, Transportation Medium Port (Port Headquarters) (T/O & E 55-120-1).
- Transportation Port Battalion (Supervising Port Companies) (T/O & E 55-116).
- Transportation Port Company (Ship Discharge) (T/O & E 55-117 or 55-118).
- Quartermaster Service Company (Labor) (T/O & E 10-67).
- Headquarters and Headquarters Company, Transportation Truck Battalion (Supervising Truck Companies) (T/O & E 55-16A).
- Transportation Light Truck Company (Port Clearance) (T/O & E 55-17A).
- Transportation Medium Truck Company, Heavy (Port Clearance) (T/O & E 55-18A).
- Transportation Amphibious Truck Company (Vessel Discharge) (T/O & E 55-37).
- Transportation Heavy Truck Company (T/O & E 55-28).
- Transportation Harbor Craft Company (Harbor Craft Operation) (T/O & E 55-500) (Cellular).
- Transportation Floating Spare Parts Depot (Spare Parts for T/O Units) (T/O & E 55-310T).
- Transportation Base Depot Company (Supplies) (T/O & E 55-260).
- Transportation Service Organization—Port Marine Maintenance Section Team BD (T/O & E 55-500).
- Medical General Dispensary Team GA (T/O & E 8-500).
- Finance Disbursing Sections (T/O & E 14-500).
- Army Postal Unit (T/O & E 12-605).
- Signal Service Teams (As desired) (T/O & E 11-500).
- Military Police Battalion (T/O & E 19-35).
- Engineer Utilities Team (T/O & E 5-500).
- Engineer Firefighting Team (T/O & E 5-500).

g. Special Cargo Handling Equipment. Requirements for general planning purposes to handle 720 short tons per day through an oversea port are as follows (does not include storage facility or depot cargo handling equipment requirements):

	1	2	3	4	5	6	7	8	9	10	11	12
1		Cranes*	Lift trucks*		Tractors*		Trailers*		Stevedore gear sets*	Gravity conveyor (feet)*	Pallets	Lighters
			3,500-lb. load	6,000-lb. load	7,500-lb. DBP	Whse.	Heavy	Whse. 2-ton				
2	Alongside discharge.....	5	3	6	2	3	2	5	2	500	200	12 lighters or 4 LSU; or 12 LCM.
3	Lighter discharge.....	6	3	6	2	3	2	5	3	500	200	

*Theater of operations commander may authorize issue of following items of cargo handling equipment to units as indicated in tables of organization and equipment. Such issue if authorized should be deducted from requirements in table above.

	1	2	3	4	5	6	7
1		Cranes	Lift trucks		Tractors		Stevedore gear sets
			3,500-lb. load	6,000-lb. load	7,500-lb. DBP	Whse.	
2	Transportation port bn hq & hq co, T/O & E 55-116.....	1 30-ton.....					6 ea. gen cargo sets.
3	Transportation port co, T/O & E 55-117.....	2 10-ton.....	3	6	2	10	1 ea. spec. cargo sets.

h. Operating Equipment. Equipment necessary for port operations can be separated into two categories:

- (1) *The first category*, equipment directly employed in ship discharge and cargo movements, includes such items as cranes, fork lift equipment, trucks, tractors, harbor craft, lighters, railway engines and cars.
- (2) *The second category*, equipment supporting the port operations, includes all maintenance utilities, power generators, repair shops.
- (3) For details of operation and capacity of port operating equipment, see the following references:

TM 55-310, Stevedoring.

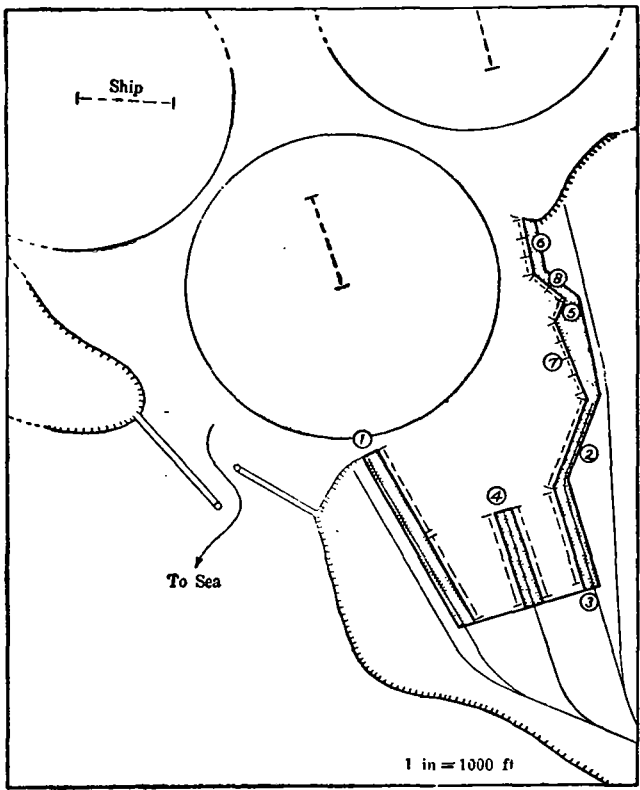
FM 55-130, Small Boats and Harbor Craft.

i. Illustrative Example of Port Capacity Estimation. The following example has been provided to demonstrate the recommended procedure for port capacity estimation based upon the steps and data outlined in the preceding paragraphs.

- (1) *Situation.* A true-scale chart of a certain harbor has been prepared for evaluation. With reference to this chart, the following additional information has been assembled:

1	2	3	4
Wharf No.	Length (feet)	Width (feet)	Minimum depth alongside at low tide (feet)
1.....	1,060	80	32.
2.....	490	60	30.
3.....	580	90	30.
4.....	535	100	34, each side.
5.....	125	54	8.
6.....	295	60	15.
7.....	450	75	22.
8.....	210	60	16.

- (a) There is sufficient area inside the harbor to anchor three ships as shown, where they can be worked continuously.
- (b) In good weather, as many as two vessels can be anchored and worked outside the breakwater.
- (c) Winds, swells, tides, and tidal currents present an unusual problem.
- (2) *Problem.* To estimate the daily capacity of this port during ideal weather.



(3) *Solution.*
(a) Discharge tonnage at deep-draft wharfage.

1	2	3
Wharf No.	Vessels which can be berthed	Rate of discharge in short tons per day
1.....	2 Victorys.....	$2 \times 720 = 1440.$
2.....	1 Victory.....	$1 \times 720 = 720.$
3.....	1 Victory.....	$1 \times 720 = 720.$
4.....	2 Victorys.....	$2 \times 720 = 1440.$
Total.....		4320.

(b) *Discharge tonnage to lighterage wharfs.*

1	2	3
Wharf No.	Lighters accom- modated	Rate of dis- charge in short tons per day
5.....	1	1×180=180.
6.....	3	3×180=540.*
7.....	4	4×180=720.
8.....	2	2×180=360.
Total.....		1,800.

*The situation shows wharf 6 to be only 295 feet long. The criterion for lighter wharfage, as given in c above limits this wharf to 2 lighters. However, since the 5-foot shortage will limit operations to no appreciable extent, it is feasible to use the 95-foot section for docking a third lighter. This has been done here.

(c) *Rate of discharge from ships at anchor to lighters.* From the situation, three ships can be anchored inside the breakwater, and two can be anchored and worked outside the breakwater in good weather. Therefore, in good weather, cargo can be discharged from ships to lighters at the rate of $(3+2) \times 720 = 3,600$ short tons per day.

(d) *Resultant daily port capacity—summary.*

1. Discharged alongside deep-draft wharfs—4,320 short tons per day.
2. Discharged from lighters to wharf—1,800 short tons per day.
3. Transferred from ships to lighters—3,600 short tons per day.
4. Therefore: 1,800 short tons per day is maximum discharge by lighter since lighter wharfage is the limiting factor in this case.
5. Total daily port capacity:
4,320 short tons per day, alongside.
1,800 short tons per day, by lighter.
Total 6,120 short tons per day.

- (4) Advance study must be made to determine the probable effect of bad weather on rate of discharge and other factors in port capacity. Continuous records of daily discharge plotted against weather and surf conditions prove valuable in planning future discharge in the same and similar ports.

232. Beaches

a. Beach Capacity.

(1) *General.* Each landing in an amphibious operation differs as to climatic and hydrographic conditions and variations in topographic features, as well as in the military situation. These variable factors make it impracticable to develop detailed logistical planning data applicable only to beaches and their capacity to receive troops and cargo. However, certain general planning data can be developed.

(2) *Beach capacity factor.* Beach capacity is an evaluation of cargo quantities that can be discharged over a given lineal beach length within a stated interval of time. During the initial phases of an amphibious operation, beach capacity will be limited to the beach (or beaches) over which the assault landing is made; later, if necessary, over-all capacity may be increased by the consolidation of beaches for more efficient operation and for the opening up of sheltered unloading points in rivers or bays. Experience has indicated that, during the assault phase of an operation, cargo can be landed and moved across beaches as follows (use either (a) or (b), or use (a) and (b) together in proportionate combination):

- (a) Average short tons of cargo per day per mile of beach..... 3,000
 (Average per 1,000 yards of beach..... 1,680)
- (b) Average numbers of vehicles and personnel landed simultaneously per day per mile of beach:
- Vehicles..... 675
 Personnel..... 4,725

(3) *Phasing data.* Amphibious operations of World War II followed a general phase relationship between assault and base development. Debarkation time and phases are not as readily distinguishable in large operations as in smaller forces. However, the pattern followed was generally the same, and is provided as general information.

Phase	Supplies involved	Elapsed time
Assault.....	Organic equipment and assault combat carried supplies	D-day to D+15.
Build-up ¹	Organic equipment, assault combat carried supplies, maintenance, and build-up (reserve).	D+15 to D+180.
Maintenance ²	Maintenance.....	After D+180.

¹ During this phase, port construction will be started and limited port operation will be initiated.

² Ports should be in operation by D+60.

b. Ship-to-Shore Supply Service. A ship-to-shore supply service will include the following:

- (1) Unloading cargo from ships into landing craft or landing vehicles.
- (2) Movement of cargo by landing craft or landing vehicles from ships to shore.
- (3) Unloading of landing craft at beaches.
- (4) Movement of cargo from beaches to beach dumps, transfer points ashore, and shore-based dumps.
- (5) Unloading at dumps or transfer points.

c. Requirements for Ship Unloading. Facilities for unloading ships anchored astream usually are limited to ships' organic gear. Using organic gear, ships normally can discharge cargo into special landing equipment faster than beaches can receive and clear the loaded landing craft and vehicles.

d. Characteristics of Amphibious Force Vessels and Craft.

- (1) *General.* Data contained in this paragraph with reference to speed and endurance may vary under operational conditions.
- (2) *Designation.* Designating letters and names are used in the following general manner:
 - (a) LC (landing craft) is applied to nonocean-going vessels of less than 200 feet overall length designed for landing operations.
 - (b) LS (landing ship) is applied to ocean-going vessels of more than 200 feet overall length and designed for participation in landing operations.
 - (c) LV (landing vehicle) is applied to small units designed for landing operations and capable of use on land or water.

(3) *Characteristics of small landing craft.*

Name	Symbol	Length	Beam	Capacity		Draft (loaded)		Speed (knots)	Range (miles)	Crew	Weight (tons) empty	Example of material carried
				Troop	Cargo (tons)	Forward	Aft					
Landing craft, vehicle-personnel.	LCVP	35'9"	10'11½"	36 or 4.05		-----	3'0"	9 -----	102-----	3	9.35	1¼-ton truck and 1¼-ton trailer.
Landing craft, mechanized (mark 3).	LCM (3)	50'0"	14'1"	100 or 30		3'6"	4'6"	11-----	850 at 6¼ knots.	4	26	1 30-ton tank, or 1 2½-ton truck and 1 1-ton trailer.
Landing craft, mechanized (mark 6).	LCM (6)	56'0"	14'1"	120 or 34		3'6"	4'6"	11-----	850 at 6¼ knots.	4	29.5	1 35-ton tank or 1 2½-ton truck and 1 1-ton trailer.

(4) *Characteristics of amphibious vehicles.*

Landing vehicle, tracked (mark 3).	LVT (3)	24'1"	-----	24 a or 4-----	No consideration need be made for the draft of amphibious vehicles.	18L b-----	150L b-----	3-4	14	4 tons, hulk cargo. 105mm howitzer.
Landing vehicle, tracked (mark 4).	LVT (4)	26'1"	10'8"	24 or 4-----		4W c-----	75W c-----			
Landing vehicle, tracked (Armored) (mark 4).	LVT (A) (4)	26'1"	10'8"	-----		20L b-----	150L b-----	3-4	13.7	1¼-ton truck.
Landing vehicle, tracked (Armored) (mark 5).	LVT (A) (5)	26'1"	10'8"	-----		5.0W c-----	50W c-----			
Truck, 2½-ton, 6 x 6 amphibious.	AMPH TRK	31'0"	9'9"	25 or 2.5-----		15L b-----	150L b-----	3-4	17.5	None.
						5.2W c-----	75W c-----			
						15L b-----	150L b-----	5	17.5	None.
						5.2W c-----	75W c-----			
						50L b-----	240L b-----	2	7.5	1 105-mm howitzer.
						5.5W c-----	35W c-----			

a Possible maximum, 30-36.

b L=land. Speed in mph.

c W=water. Speed in knots.

(5) *Characteristics of landing ships.*

Name	Number ships in class	Class	Type	Troop capacity	Combat load (short tons)	Troop cargo (cu. ft.)	Troop cargo (sq. ft.)	LCM carried	LCVP carried	Length (overall)	Draft (ft.)
LST: 1, 513, 531.....		1	Elevator, 10-ton capacity.		500 tons.....	92,765.....	6,328, tk deck; 4,500, main deck.	0	2-6	328'	Landing—500 tons, 3'0" fwd, 9'8" aft. Oceangoing—1,431 tons, 8'0" fwd, 14'4" aft.
514-530, 532 up.....		542	Ramp, 17-ton capacity.	167 *	Tank deck—17 LVT or 21 amph trk or 12 medium tk or 10 tk w/T6. Main deck—24 2½-ton trk or 44¼-ton trk.	92,765.....	6,328, tk deck; 4,500, main deck.	0	2-6	328'	Landing—500 tons, 3'0" fwd, 9'8" aft. Oceangoing—1,431 tons, 8'0" fwd, 14'4" aft.
1153-1154.....	2	1153	Ramp, 25-ton capacity (apprx.).	197 *	Tank deck—21 LVT. Main deck—35 2½-ton trk.	100,900.....	8,072, tk deck; 6,268, main deck.	0	4	328'	Landing—560 tons, 3'8" fwd, 10'4" aft. Oceangoing—2,565 tons, 9'9" fwd, 16'1" aft.
LSM.....		1	Open well.....	54 *	5 medium or 3 hv tk or 6 LVT or 9 amph trk or 165 tons cargo.	21,027 (open well).	3,186.....	0	0	203'6"	Landing—165 tons, 3'5" fwd, 7' aft. Oceangoing—387 tons, 4'5" fwd, 8' aft.

RESTRICTED—Security Information

RESTRICTED

(5) *Characteristics of landing ships—Continued*

Name	Number ships in class	Class	Type	Troop capacity	Combat load (short tons)	Troop cargo (cu. ft.)	Troop cargo (sq. ft.)	LCM carried	LCVP carried	Length (overall)	Draft (ft.)
LCU (6)	-----	-----	Open well	8, for short distances 400.	5-30 tons tk or 3-50 tons tk or 165 tons cargo (maximum beaching capacity).	10,974	1,829	0	0	120'4"	Landing—165 tons, 3'7" fwd, 4'2" aft.

* Troop capacity may be increased by berthing troops on cots.

NOTES

1. A boat space is the space and weight allowed one soldier with his individual combat equipment. It is 224 pounds or 13.5 cubic feet. When computing boat spaces required for cargo, use either the weight or the space occupied, whichever is greater. Hand carts, loaded or empty, require two boat spaces.

* Running time may be computed from the formula $t = \frac{3d}{s}$ where

d = distance run in hundreds of yards.

s = speed in knots (1½ mph).

t = running time in minutes.

(6) *Characteristics of transport type vessels.*

Name	Number ships in class	Class	Type	Troop capacity	Combat load (short tons)	Troop cargo (cu. ft.)	Troop cargo (sq. ft.)	LCM carried	LCVP carried	Length (overall) (feet)	Draft (feet)
LSD: ¹ 1-22, 25, 26, 27	-----	-----	-----	332	(²)	Open well deck	16,691	-----	2	458	17
APD:	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1-36	-----	Manley	EX-DD	275	6¼-ton trk, 2 1-ton trk, 4 carts.	9,000	-----	-----	4	314	12
37-139	-----	Bates	EX-DE	170	6-10 tons	9,000	-----	-----	4	306	13

¹ 8blps of this class are now being fitted with a deck over the well deck for use in carriage of additional trucks or cargo. Helicopters can also land.

² (1) Well deck loaded: a. 3 LCU's fully loaded; or b. 18 LCM's (6) loaded; or

c. 27 LCVP or 41 LVT or 47 amphibious trucks. (2) Frequent load: 3 LCU each preloaded with tanks. (3) Draft loaded: a. Draft loaded—18'; b. Ballasted for discharge—29'.

e. *Cargo Movement by Amphibious Trucks.* Amphibious trucks are specialized equipment of exceptional value in amphibious operations which enable direct movement of cargo from ships to shore-based dumps. Experience indicates that amphibious trucks are capable of movement of 720 short tons per company per day for overall in-and-out of water operations. This factor may be used for *general planning* purposes.

f. *Equipment Required for Operations on the Beach, for Beach Clearance, and for Operations in Shore-Based Dumps.* World War II experience consistently showed a lack of sufficient shore-based equipment to receive cargo as rapidly as unloading from ships could be effected. Resulting bottlenecks at beaches and at beach dumps could have been avoided had additional cargo-handling equipment, particularly cranes, been available. It was found that cargo handling equipment best adapted to beach and shore dump employment were cranes, tractors, and trucks. Detailed characteristics of these items are outlined below.

(1) *Cranes.* Cranes should be self-propelled, of medium and heavy types, with booms 40 feet in length to permit lifting filled cargo nets. Each crane can handle discharge from 3 LCUs, 8 LCMs, or 12 LCVPs under normal beach operations where sufficient trucks or tractors are available to haul or dray away unloaded cargo.

(2) *Tractors.* Medium and heavy tractors, on an average, can tow two loaded sled pallets. This type movement from beach to dump is slow and less satisfactory than movement by truck. However, for dragging pallets from landing craft and within supply dumps, tractors are effective. Tractors are invaluable for clearing the beach and dump areas of mired vehicles. Eight to ten tractors per assault division, six to seven on beaches, and two to three in supply dumps, are usually sufficient. Several tractors assigned to a beach should be equipped with angledozers.

(3) *Trucks.* See paragraphs 213 through 221.

g. *Beach Service Troop Requirements.* Service troops are employed throughout the supply-service cycle from ship unloading to segregation and storage of supplies in shore-based dumps. The multiple functions performed in this cycle require both general and special service type units. Care must be exercised in balancing the type of troops employed, for a breakdown in service troops' functioning will render available equipment partially or completely ineffective.

233. Inland Terminals

a. Definition. Inland terminals are defined as those inland intransit points where cargo is—

- (1) Temporarily held intransit awaiting disposition instructions.
- (2) Transferred from one mode of transportation to another.
- (3) Broken down from bulk shipments and reshipped in small units.
- (4) Collected from other points to make a transportation unit for reshipment.

b. Capacity Estimation. Inland terminal capacity is the total tonnage that can be *received, processed, and cleared* through the terminal in any one day. The terminal capacity is estimated by analyzing three major factors—reception capacity, loading and unloading or transfer capacity, and clearance capacity—to ascertain which is the limiting factor, and then determining its value as expressed in daily tonnage. The following is a checklist for estimation of inland terminal capacity:

INLAND TERMINAL CAPACITY

Collect these data where applicable

Compute these factors

Determine

1. Channel depths-----
2. Obstructions-----
3. Capacity of rail facilities.
4. Capacity of highway facilities.
5. Capacity of pipeline facilities.
6. Capacity of air facilities.
7. Enemy air activity----
8. Enemy surface activity.
9. Climate-----
10. Weather-----
11. Contaminated areas---
12. Our own capabilities in combating obstacles.

- (1) Evaluate to determine:
A. Inland terminal reception capacity.

1. Tactical dispersion requirements.
2. Wharf and/or platform facilities.
3. Discharge rates-----
4. Unloading rates-----
5. Loading rates-----
6. Extent of destruction or contamination.
7. Climate and seasons---
8. Weather and tide characteristics.
9. Materials-handling equipment available.
10. Cargo-handling equipment available.
11. Floating craft and equipment available.
12. Airfield capabilities----
13. Transit sheds, yards, and areas.
14. Indigenous labor available.
15. Space reserved for local economy.

- (2) Evaluate to determine:
B. Loading and/or unloading or transfer capacity.

Inland terminal capacity.

1. Capacity of rail facilities.
2. Capacity of highway facilities.
3. Capacity of inland waterway facilities.
4. Capacity of pipeline facilities.
5. Capacity of air facilities.

- (3) Add to determine:
C. Clearance capacity.

c. Estimation of Equipment. Equipment requirements are determined by analyzing the projected work load of the inland terminal in relation to the tonnages and types of cargo to be unloaded, loaded, and transferred. See paragraphs 231g and h for planning data on cargo handling equipment.

d. Estimation of Personnel Requirements. Personnel requirements are determined by evaluating the mission of the inland terminal in terms of work load, equipment to be manned, and services to be performed. To insure maximum efficiency in terminal operation, a balanced force of general special service units and supervisory elements must be available. The use of indigenous and prisoner of war labor should be considered.

234. Air Terminals

Complete data not available at time of printing this manual.

Section X. TRANSPORT AIRCRAFT

235. General

a. The movement of troops by air transport normally is ordered by the headquarters in command of both the transported and transporting units. These orders are issued simultaneously to the commander of the unit to be transported and to the commander of the transporting unit.

b. Troop movements by air are of two types: tactical and administrative. When the move is tactical, the loading plans will depend upon the tactical mission to be accomplished at the end of the move. An administrative move is merely a ferrying operation from one base to another. It is not feasible to prescribe standard tactical loads for the air transport of personnel and equipment because of the variable conditions surrounding each operation. For example, the loading plans will vary depending upon the mission, the aircraft available, the distance to be flown, the conditions of the flight, the security of the landing area, the time available for disassembly and assembly of equipment, the amount of supplies to be transported with the troops, the size of engineer tools needed in the terrain to be encountered, and other factors. For more technical data on the loading of transport aircraft, see TM 57-210 and AFM 115-65-1.

c. The air movement of a large body of troops normally will involve concurrent departures from several airdromes, and, in the base of air-landed operations, concurrent landings at several terminal air strips. The availability of transport aircraft and base facilities, the urgency of the situation, and the likelihood of hostile interference will be major factors which determine the number of installations employed, as well

as the number of turn-arounds to be made by the transporting aircraft. For considerations governing the employment of air transportation, see FM 100-5. For staff procedures, air movement tables and other forms relative to air movements, see FM 57-20, FM 57-30, and TM 57-210.

236. Airfield Capabilities

a. Improved airfields in rear of combat zones can serve as a base for 200 aircraft. Under ideal conditions, aircraft land or take-off at 3-minute intervals, and 1 hour on the ground is required for each landing for necessary servicing, reloading, and inspection.

b. Unimproved airfields and landing strips in rear of the combat zone can serve as a base for 100 aircraft.

c. Transport aircraft normally will not be based in the combat zone. On airfields in the combat zone, aircraft land or take-off at 3-minute intervals under ideal conditions and the time required on the ground is reduced to 30 minutes. Service and maintenance is limited to emergency requirements only, and the tactical situation normally will not permit more time than that required for actual unloading and reloading.

d. For transport aircraft use, airfields in rear of the combat zone should be considered operational both day and night, while airfields in the combat zone should be considered operational during daylight hours only.

237. Transport Aircraft Capabilities

a. Specific transport aircraft capabilities are affected by the age of the aircraft, the state of modification, the nature of the climate and terrain in operating areas, and many other variable factors. In preparing for air movements, it is always necessary to secure specific capabilities from the Air Force operating agency which is to execute the move.

b. Availability of transport aircraft for continuous operation and for planning purposes may be taken as 75 percent of the total aircraft assigned to the project.

238. Air Movement of Supplies

a. *General.* Supplies may be free-dropped, landed as bulk shipments in powered aircraft, or landed by parachute in standard containers.

b. *Bulk Supplies.*

- (1) When using aircraft to move bulk supplies the allowable cargo load to be carried will be determined by the radius or

RESTRICTED—Security Information

range to be flown. The allowable cargo loads of aircraft operating under *radius conditions* can be determined from the graphs in paragraph 239c.

- (2) To determine the aircraft requirements for bulk supplies, the following formula may be used:

(Airplanes—all types):

$$y = \frac{b}{x}$$

y = number aircraft required.

b = weight of supplies in pounds to be landed.

x = allowable cargo load of airplane in pounds for radius or range used.

Example.—To determine C-119 aircraft requirements for air landing of 600 tons of supplies to be moved 500 miles under radius conditions.

1. Allowable cargo load for 600 miles under radius conditions is determined to be 17,000 pounds.

2. Total weight of supplies $600 \times 2,000 = 1,200,000$ pounds.

3. $y = \frac{1,200,000}{17,000} = 70.6$ or 71 C-119s.

c. Parachute.

- (1) The amount of supplies to be landed by parachute from various type airplanes is dependent on the number and type of containers that can be carried, and rapidly discharged from the airplane. Three airplanes, the C-82, C-119, and C-97, are fitted with monorail and floor level conveyor systems, which facilitate the rapid discharge of the containers. The net weight of supplies carried in each type airplane thus differs, due to the capabilities of the aerial delivery system, and is much less than the allowable cargo load of the airplane at most distances.
- (2) To determine aircraft requirements for the delivery of parachute supplies, the same basic formula used for bulk supplies may be used:

$$y = \frac{b}{x}$$

The value of x can be determined from the graphs for the type aircraft given in paragraph 239c, below (fig. 57, 59, 61, 63, 65, 66).

- (3) Under special conditions the three aircraft listed in (2) above, may carry greater tonnages of net supplies. Other aircraft also may be utilized to deliver parachute supplies, the amount to be carried being dependent on the existing conditions for dropping the containers.

239. Cargo Aircraft

a. General. The data in this paragraph are designed to present for use by division, corps, and higher staff planners those characteristics and capabilities of cargo aircraft needed by them in the conduct of planning for airborne operations. The aircraft data presented are an estimate of the actual performance data which may be expected during time of war. Some aircraft loads exceed design load conditions but are within acceptable alternate overload limits. The method of presentation used is designed to show the capabilities of the several aircraft in each of the types of operations in which they may be employed. These operations are—

Parachute

Air-transport

b. Glossary of Terms.

Allowable cargo load (air)—The amount of cargo, determined by weight, cubic displacement, and distance to be flown, which may be transported by aircraft. In an airborne operation, the Air Force commander will announce the allowable cargo load for each type aircraft.

Variations in the allowable cargo load—The allowable cargo load of an aircraft varies according to distance and certain other conditions. The greater the distance, the greater the weight of fuel and resultant reduced allowable cargo load. In radius operations, the allowable cargo load for the distance traveled, for parachute operations, generally is greater than that for air-landed operations. This is due to the fact that in air-transported operations there is a necessary safety restriction on the total weight of the aircraft on landing. The allowable cargo load for an aircraft can be determined for any range or radius by reference to graphs provided for that purpose.

Radius of action—The maximum distance to which an airplane can safely travel and return without refueling. Operations under radius conditions are those in which aircraft deliver troops or materiel at a destination and return without refueling.

Range—The distance from the take-off point to the point where an airplane delivers its cargo load (safety margin of reserve fuel included). Refueling is required to return to the original take-off point.

Typical safe equipment loads—These are combination equipment loads within the weight limits of the allowable cargo load that expeditiously and safely can be loaded into a cargo aircraft without modification or disassembly, and which can be balanced and secured for safe flight. Vehicle and trailer loads are computed on empty weights for simplicity. This permits simple computation of remaining weight capacities.

Weight factors—The following factors are used in all computations:

A fully equipped parachutist weighs 260 pounds.

A fully equipped passenger weighs 240 pounds.

Representative types of aerial delivery containers:

A-5 Container. Net capacity—224 pounds, gross weight—300 pounds.

A-7 Modified Container. Net capacity—470 pounds, gross weight—500 pounds.

A-21 Container. Net capacity—443 pounds, gross weight—500 pounds.

A-22 Container. Net capacity—2,015 pounds, gross weight—2,200 pounds.

The 6,000-pound load bearing platform has a net capacity of 6,000 pounds, and a gross weight of 7,850 pounds.

c. Aircraft characteristics.

(1) *C-54 Skymaster.*

(a) *Description.* The C-54 Skymaster is a low-wing, all metal, four engine medium transport. (Limited standard.)

(b) *Troop transport provisions.*

1. Number of troop seats—49.

2. Troop entrance—through door at left rear of fuselage by means of removable step or organic ladder.

3. Baggage—in cargo compartment with troops or in compartment below flight deck.

(c) *Litter transport provisions.* Number of litter positions—36.

(d) *Cargo transport provisions.*

1. Cargo compartment dimensions.

(a) Length—597 inches.

(b) Width—108 inches.

(c) Height—93 inches.

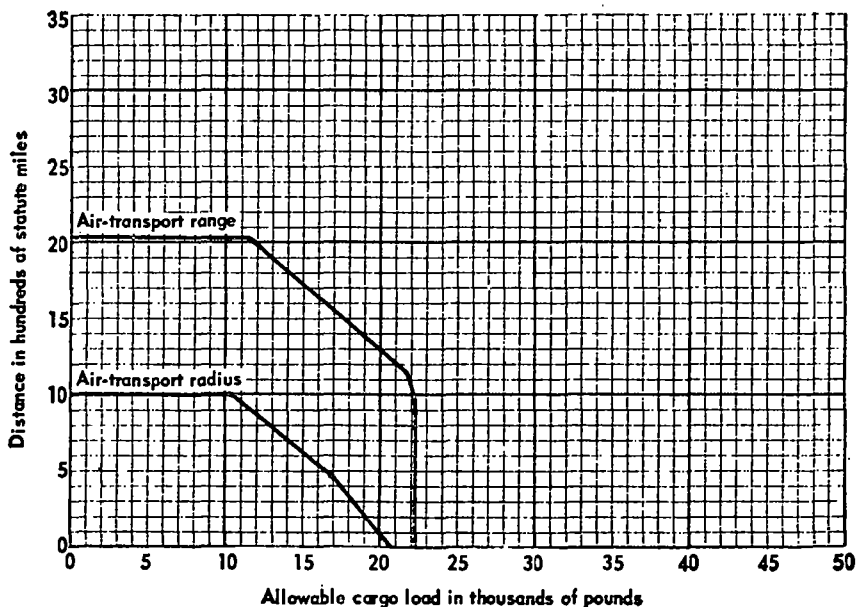
2. Height of cargo entrance above ground—100 inches.

3. Cargo doors.

(a) Location—left rear side of fuselage.

(b) Dimensions—95" wide x 67" high.

4. Cargo loading aids.*
 - (a) Vehicles—portable ramps.
 - (b) Cargo (bulk)—cargo hoist at door—capacity 2,000 pounds.
 - (c) *Parachutist provisions.* The airplane is not equipped for parachute operations, but can be adapted with minor modification to jump a single stick out of the left rear door.
 - (f) *Aerial delivery provisions.* There are no special provisions for the aerial delivery of supplies or equipment from this airplane.
 - (g) *Aerial towing provisions.* Some models of this airplane have a towing attachment rated at 16,700 pounds which is not adequate to tow the C-123 Medium Assault Transport, but could be utilized to tow liaison type airplanes or light cargo helicopters.
 - (h) *Typical safe equipment loads.*
 1. 1 truck, $\frac{1}{4}$ ton 4 x 4. 1 howitzer, 105-mm, M2A1 or carriage M2A2.
 2. 1 truck, $\frac{1}{4}$ ton 4 x 4. 1 gun, 76-mm, AT, T-124 on carriage T66.
 3. 1 truck, $\frac{1}{4}$ ton, 4 x 4. 1 gun, 40-mm, M1 on carriage, M2A1.
 4. 4 trucks, $\frac{1}{4}$ ton, 4 x 4. 2 trailers, $\frac{1}{4}$ ton, 2-wheel, cargo.



*These aids not generally available on aircraft now in service.

(2) *C-82 Packet.*

(a) *Description.* The C-82, Packet is a high wing, twin boom, all metal, medium transport. (Limited Standard.)

(b) *Troop transport provisions.*

1. Number of troop seats—41.
2. Troop entrance—through door at left front of fuselage by means of organic ladder.
3. Baggage—in cargo compartment with troops.

(c) *Litter transport provisions.*

1. Number of litter positions—34.
2. Attendants—4.

(d) *Cargo transport provisions.*

1. Cargo compartment dimensions—see page 404.
2. Height of cargo entrance above ground—48''.
3. Ground clearance under horizontal stabilizers—168''.
4. Cargo door.
 - (a) Location—rear of fuselage.
 - (b) Dimensions—see page 404.
5. Cargo loading aids.
 - (a) Vehicles—portable ramps and snatch block fittings.
 - (b) Bulk cargo—truck bed height of cargo floor and snatch block fitting for heavy loads.

(e) *Parachutist provisions.*

1. Maximum capacity—41.
2. Exit doors—at rear of fuselage on each side of the compartment.
3. Accompanying supplies—can be dropped from the interior aerial delivery system.

(f) *Aerial delivery provisions.*

1. "Pararacks"—early model aircraft are equipped with interior vertical "Pararacks" which drop containers through the paratainer well. Capacity of pararacks—10—500-pound containers.
2. Monorail—late model aircraft are equipped with an interior overhead monorail system for discharging supplies through the paratainer well. Capacity of the monorail—15—300 pound containers.
3. Floor level conveyors—all models of this aircraft can be fitted for ejecting supplies or equipment from the rear of the fuselage. The clamshell cargo doors are removed and the supplies or equipment are placed on top of wheel conveyors positioned on the floor of the cargo compartment. Capacity of the conveyor system is governed only by the allowable cargo load, and interior

dimensions. (Example: Three 2,200-pound containers can be loaded and dropped on a 484 mile radius mission.)

- (g) *Aerial towing provisions.* All models of this airplane have a towing attachment rated at 30,000 pounds which is not adequate to tow the C-123 Medium Assault Transport, but could be utilized to tow liaison type airplanes or cargo helicopters.

- (h) *Typical safe equipment loads (air-landed).*

1. 1 truck, $\frac{3}{4}$ ton, 4 x 4, and 1 trailer, 1 ton, 2w cargo.
2. 1 truck, $\frac{3}{4}$ ton, 4 x 4 and 1 howitzer, 105-mm, M2A1, on carriage M2A2.
3. 1 truck, $\frac{3}{4}$ ton, 4 x 4 and 1 gun, 76-mm, AT, T-124, on carriage T-66.
4. 1 truck, $\frac{3}{4}$ ton, 4 x 4 and 1 gun, 40-mm, M1 on carriage M2A2.
5. 1 truck, 2½ ton, 6 x 6, cargo.
6. 2 carriers, cargo, M29.
7. 3 trucks, $\frac{1}{4}$ ton. 3 trailers, $\frac{1}{4}$ ton.

- (i) *Heavy drop capabilities.* The C-82 can drop the following heavy equipment ¹ intact:

1. 2 trucks, $\frac{1}{4}$ ton.
2. 1 truck, $\frac{1}{4}$ ton, and 1 howitzer, 105-mm.
3. 1 truck, $\frac{1}{4}$ ton, and 1 trailer, $\frac{1}{4}$ ton.
4. 6,000 pounds of boxed supplies. (See graph on next page.)

- (3) *C-119 Packet.*

- (a) *Description.* The C-119 Packet is a high wing, twin boom, twin engine, all metal, medium transport.

- (b) *Troop transport provisions.*

1. Number of seats—42 (20 additional seats can be installed).
2. Troop entrance—through at left front of fuselage by means of organic ladder.
3. Baggage—in cargo compartment with troops.
4. Number of air transported troops—62.

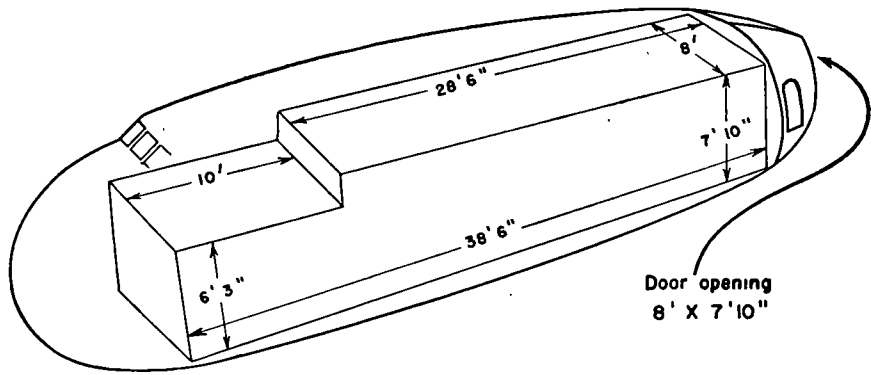
- (c) *Litter transport provisions.*

1. Number of litter positions—35.
2. Attendants—4.

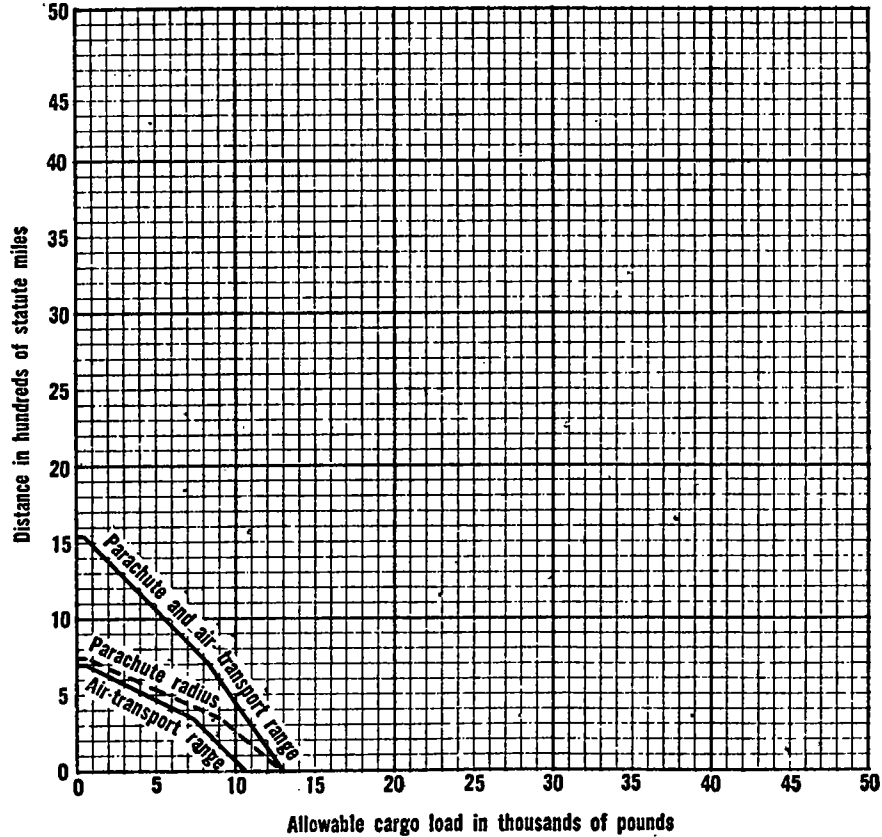
- (d) *Cargo transport provisions.*

1. Cargo compartment dimensions—see page 406.
2. Height of cargo entrance and floor above ground—48".
3. Ground clearance under horizontal stabilizers—164".
4. Cargo door:
 - (a) Location—rear of fuselage.
 - (b) Dimensions—see page 406.

¹ A small crew jumps with the equipment.

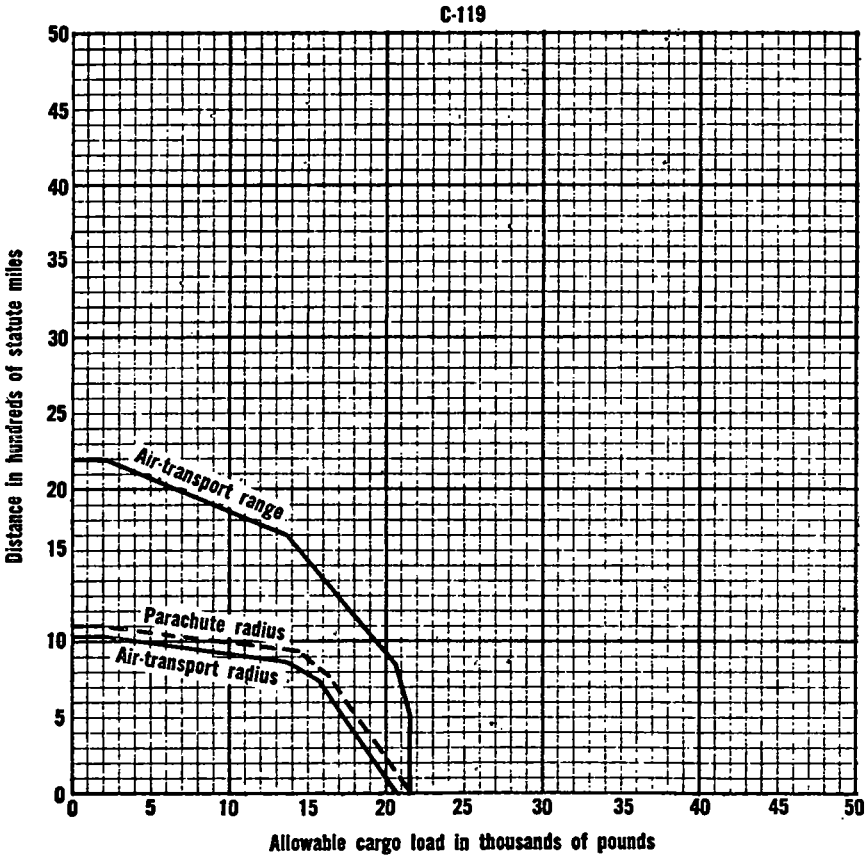
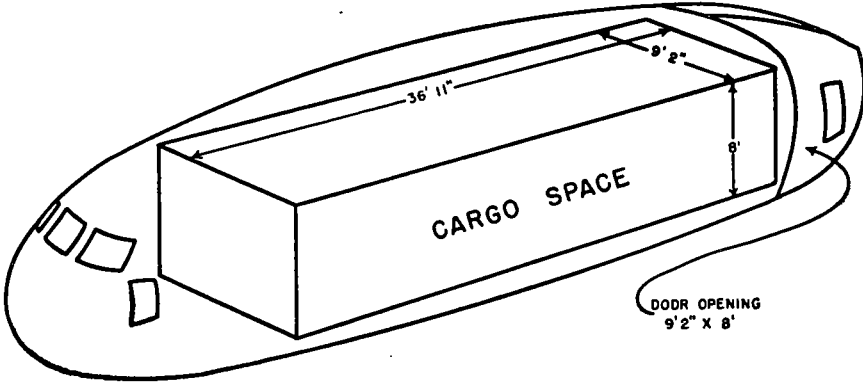


C-82



5. Cargo loading aids:
 - (a) Vehicles—portable ramps and snatch block fittings.
 - (b) Bulk cargo—truck bed height of cargo floor and snatch block fitting for heavy loads.
- (e) *Parachutist provisions.*
 1. Maximum capacity—42.
 2. Exit doors—at rear of fuselage on each side of the compartment.
 3. Accompanying supplies—can be dropped from the interior aerial delivery system.
- (f) *Aerial delivery provisions.*
 1. Monorail—aircraft are equipped with an interior overhead monorail system for discharging supplies through the paratainer well. Capacity of the monorail—20—500-pound aerial delivery containers (10,000 pounds).
 2. Floor level conveyors—all models of this aircraft can be fitted for ejecting supplies or equipment from the rear of the fuselage. The clamshell cargo doors are removed and the supplies or equipment are placed on top of wheel conveyors positioned on the floor of the cargo compartment. Capacity of the conveyor system is governed only by the allowable cargo load and interior dimensions of the aircraft. With clamshell doors removed, seven 2,200-pound A-22 (aerial resupply) equipment containers can be ejected from the cargo compartment out of the cargo door on a 806 mile radius mission.
- (g) *Aerial towing provisions.* All models of this airplane have a towing attachment rated at 30,000 pounds which is not adequate to tow the C-123 Medium Assault Transport, but can be utilized to tow liaison type airplanes or light cargo helicopters.
- (h) *Typical safe equipment loads (air-landed).*
 1. 3 trucks $\frac{1}{4}$ ton 4 x 4, and 3 trailers $\frac{1}{4}$ ton.
 2. 2 weapons carrier $\frac{1}{4}$ ton, 4 x 4.
 3. 1 truck, cargo, $2\frac{1}{2}$ ton, LWB, 6 x 6, with canvas cab.
1 truck, $\frac{1}{4}$ ton, 4 x 4, and 1 trailer, cargo, $\frac{1}{4}$ ton, 2-wheel.
 4. 1 truck, cargo, $2\frac{1}{2}$ ton, SWB, 6 x 6, with winch, canvas cab.
1 howitzer, 105-mm, M2A1, carriage M2A2.
 5. 1 car, armored, utility, M20, 6 x 6.
 6. 1 tractor, crawler type, Diesel, 8600-12000 DBHP, D6, with dozer.

RESTRICTED—Security Information



7. 1 truck, $\frac{3}{4}$ ton, 4 x 4 and 1 gun, 76-mm, AT, T-124 on carriage T-66.

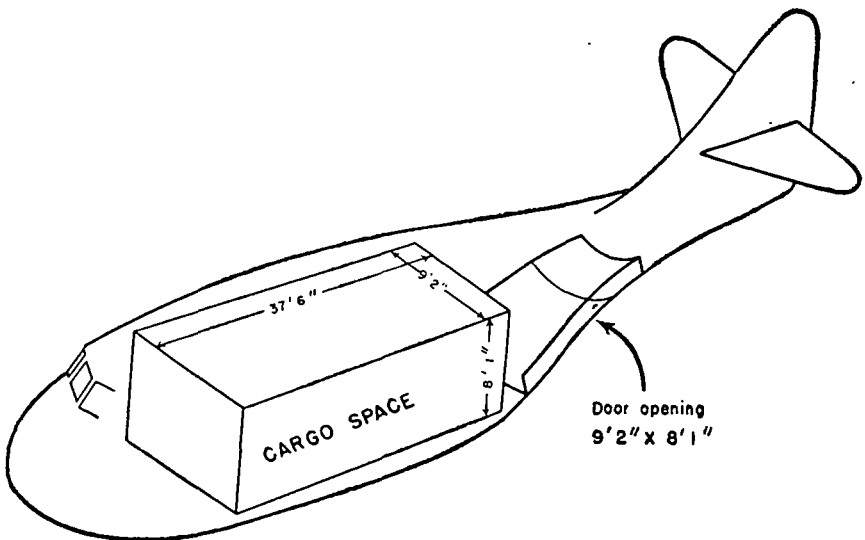
Note.—Combinations above can be carried only at distances for which the allowable cargo load is more than the stated total weight of the vehicles.

- (i) *Heavy drop capabilities.* The C-119 can drop the following heavy equipment intact:

1. 3 trucks, $\frac{1}{4}$ ton and 7 personnel.
2. 2 trucks, $\frac{3}{4}$ ton, and 8 personnel.
3. 1 truck, $2\frac{1}{2}$ ton, 1 trailer $\frac{1}{4}$ ton, and 7 personnel.
4. 1 truck, $\frac{1}{4}$ ton 1 gun, at 76-mm and 12 personnel.
5. 1 truck, $\frac{1}{4}$ ton, 1 howitzer 105-mm, 2 containers 2,200 pounds and 7 personnel.
6. 1 gun, 40-mm, 1 quad 50 MG, 1 container 2,200 pounds and 7 personnel.
7. 2 cargo carriers, M 29 C (weasel).
8. 18,000 pounds of boxed supplies.
9. 7 containers, 2,200. pounds and 7 personnel.
10. 1 D-4 dozer and 2 personnel.
11. 1 155-mm howitzer and 7 personnel.

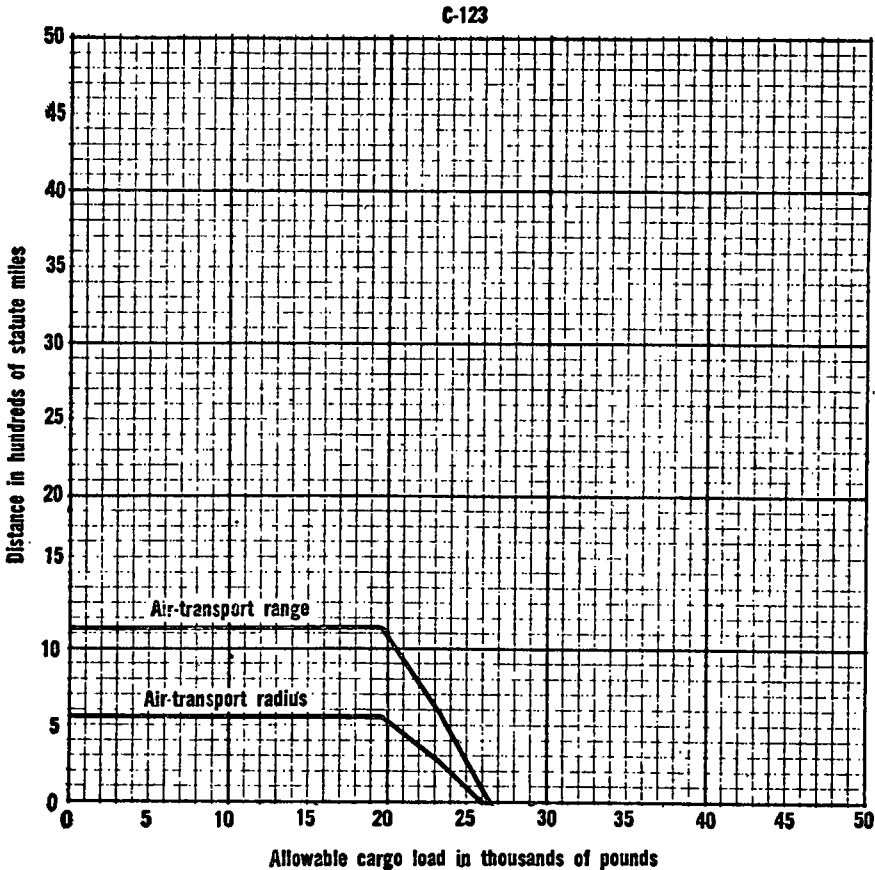
- (4) C-123.

- (a) *Description.* The C-123 medium assault airplane is a high-wing, twin engine, full-cantilever monoplane of metal and steel tubing construction. It is capable of landing and taking off from unprepared fields.



RESTRICTED—Security Information*(b) Troop transport provisions.*

1. Number of troop seats—60.
2. Troop entrance—personnel doors on each side in rear portion of the fuselage. Dimensions—60 $\frac{1}{2}$ " high, 30 $\frac{1}{2}$ " wide. An additional door is located on the left side in the forward portion of the fuselage.
3. Baggage—in cargo compartment with troops.
4. Number of air transported troops—60.

(c) Litter transport provisions. Number of litter positions—50.*(d) Parachute provisions.* This aircraft is not presently equipped with personnel parachute provisions but tests are to be conducted to determine its parachute capability.*(e) Aerial delivery provisions.* The C-123 will be tested in the near future for dropping heavy equipment by the use of floor conveyors.

(f) *Aerial towing provisions.* This aircraft has a towing attachment and can tow light planes and light helicopters.

(g) *Typical equipment loads.*

1. 3 trucks, $\frac{1}{4}$ ton, 4 x 4, and 3 trailers, $\frac{1}{4}$ ton.
2. 2 trucks, weapons carrier, $\frac{3}{4}$ ton, 4 x 4.
3. 1 howitzer, 155-mm, M1.
4. 1 compressor, air, truck-mounted gasoline engine.
5. 1 carrier, half-track. 1 81-mm mortar, M21.
6. 1 truck, cargo, $2\frac{1}{2}$ ton, 6 x 6 SWB, with canvas cab, and 1 howitzer, 105-mm, M2A1, on carriage, M2A2.
7. 1 tractor, crawler type, Diesel, 8600-12000 DBHP, D-6, with dozer.

Note.—Combinations above can be carried only at distances for which the allowable cargo load is more than the stated total weight of the vehicles.

(5) *C-124.*

(a) *Description.* The C-124 is a low wing, all metal, four engine, heavy transport monoplane.

(b) *Troop transport provisions.*

1. Number of troop seats—200 (located on two decks).
2. Baggage—in cargo compartment with troops or in compartments below flight deck.
3. Troop steps or ramp for personnel.

(c) *Litter provisions.* Number of litter positions—132 (in place of seats).

(d) *Parachutist provisions.* Initial models are not equipped for parachute operations, but later models will contain provisions for parachuting personnel, supplies, and to a degree, heavy equipment.

(e) *Cargo transport provisions.*

1. Overall dimensions—(see page 410).
2. Cargo compartment equipped with two decks.
3. Cargo door—clamshell doors open lower half of nose of airplane.
4. Cargo and equipment can be loaded either through the nose door by use of a ramp or by elevator in the aft end of the cargo compartment.
5. Dimensions of cargo door in nose—140'' high x 136'' wide.
6. Cargo elevator dimensions—160 inches long x 92 inches wide, capacity—16,000 pounds. Ground clearance of aircraft at elevator well—105''.

(f) *Aerial towing provisions.* Early models are not equipped with aerial towing provisions, but later models are to be so

RESTRICTED—Security Information

equipped with a provision of sufficient capacity to tow the C-123 Medium Assault Transport.

(g) *Typical equipment loads.*

1. 8 trucks, $\frac{1}{4}$ -ton, 4 x 4, and 8 trailers, $\frac{1}{4}$ -ton, 2-wheel.
2. 1 tank, light, M-41.
3. 1 howitzer, 155-mm, M1, on carriage, M1A2.
4. 1 tractor, high-speed, 13-ton M5A3.
5. 1 truck, $2\frac{1}{2}$ -ton, 6 x 6, cargo, SWB, with winch.
6. 1 truck, $2\frac{1}{2}$ -ton, 6 x 6, cargo, LWB.
7. 1 howitzer, 105-mm, M2A1, on carriage, M2A2; and 1 trailer, ammunition M10.
8. 1 carriage, motor, twin 40-mm gun, M19.
9. 1 truck, $\frac{1}{4}$ -ton, 4 x 4; 1 trailer, 1-ton, 2-wheel ammunition; 1 trailer, $\frac{1}{4}$ -ton, 2-wheel, cargo.
10. 1 vehicle, utility, armored M44.
11. 2 graders road, motorized diesel, engine driven 12-foot mold board.
12. 1 gun, 90-mm, AA, M2, with equipment and supply; 1 truck, $2\frac{1}{2}$ -ton, 6 x 6 cargo.

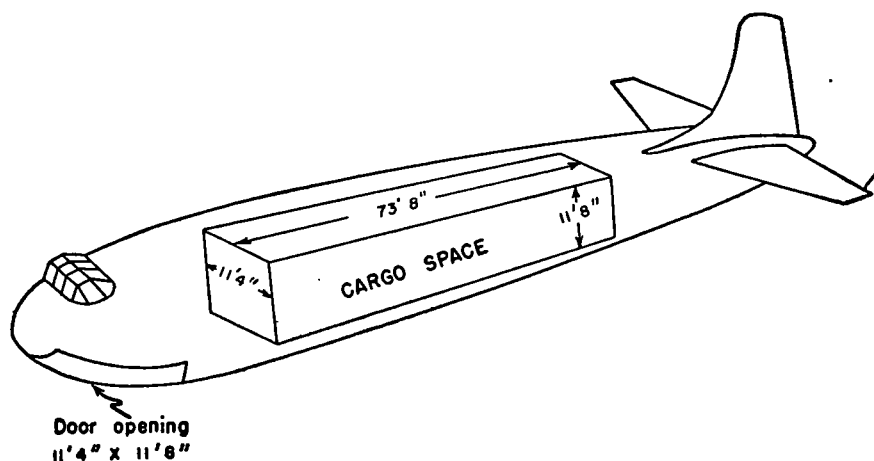
Note.—Combinations above can be carried only at distances for which the allowable cargo load is more than the stated total weight of the vehicles.

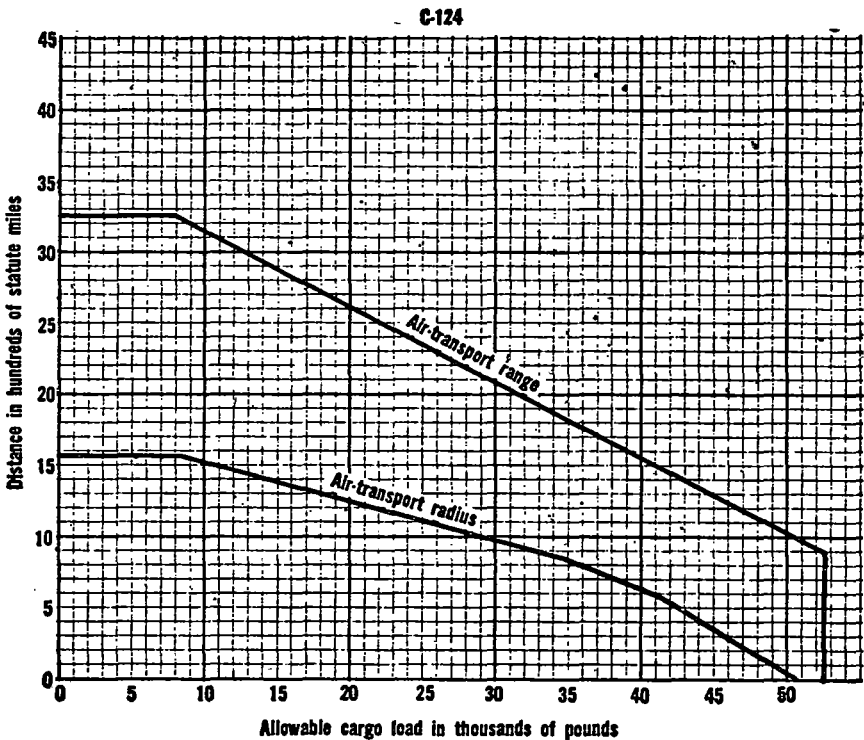
(6) *C-97, Stratofreighter.*

(a) *Description.* The C-97 is a low-wing, all-metal, four engine heavy transport airplane.

(b) *Troop transport provisions.*

1. Number of troop seats—134.



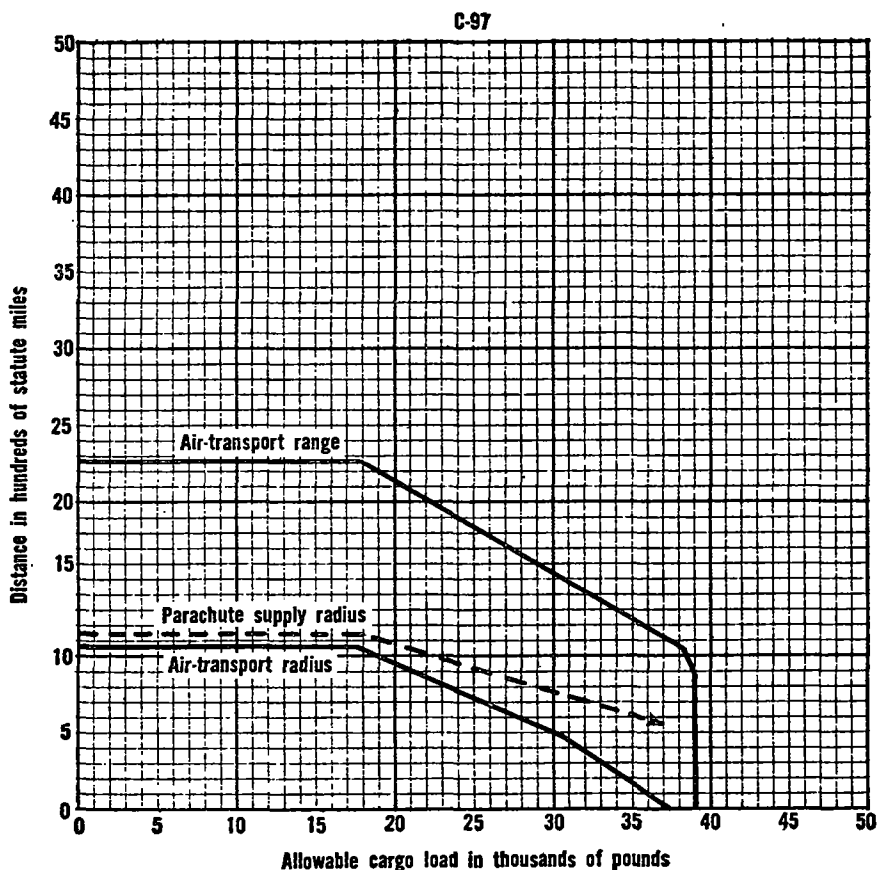


2. Troop entrance—one door on each side of main compartment, one door on left side of lower front compartment.
3. Means of loading—troop steps or ramp for personnel, ramp for vehicles.
- (c) *Litter transport provisions.* Number of litter positions—83 (in place of seats).
- (d) *Cargo transport provisions.*
 1. *Cargo compartment provisions.*
 - (a) Main cargo compartment—764'' long, 105½'' wide (maximum), 87'' (minimum); 96'' high (maximum); 87'' high (minimum).
 - (b) Lower cargo compartments, two each—264'' long; 74'' wide, and 60'' high.
 2. Height of cargo compartment above ground—164 inches.
 3. Cargo door—on rear underside of fuselage on level of main compartment. Size opening—88'' to 110'' wide x 96'' to 120'' high.
- (e) *Parachutist provisions.* This aircraft is not equipped for personnel parachute operations.

(f) *Aerial delivery provisions.*

1. Overhead monorail conveyors are provided which drop containers through flight operable rear cargo doors. The capacity of the overhead monorail is 85—300 pounds or 15—1,500-pound containers (using A-22 containers).
2. Floor level conveyors from cargo doors are provided for gravity ejection during flight.
3. The capacity for dropping packaged supplies from floor level conveyor is limited only by allowable cargo load.
4. Heavy dropping of equipment from the C-97 has not yet been tested.

(g) *Aerial towing provisions.* The C-97 is not presently equipped with a towing attachment.



(h) *Typical equipment loads.*

1. 6 trucks, $\frac{1}{4}$ -ton 4 x 4.
2. 4 trucks, weapons carriers, $\frac{3}{4}$ ton, 4 x 4.
3. 2 trucks, weapons carriers, $\frac{3}{4}$ ton, 4 x 4. 2 guns 40-mm, M1, on carriage M2A1.
4. 3 trucks, cargo, SWB, $2\frac{1}{2}$ -ton, 6 x 6, w/canvas cab.

Note.—Combinations above can be carried only at distances for which the allowable cargo load is more than stated total weight of the vehicles.

Section XI. OCEAN SHIPPING

240. Definition of Ship-Loading Terms

a. *Units of Weight.*

Short ton=2,000 pounds.

Long ton=2,240 pounds.

Metric ton=2,205 pounds (1,000 kilograms).

b. *Units of Volume.*

(1) Measurement ton=40 cubic feet.

(2) Register ton=100 cubic feet. (This tonnage is used for working out a basis to collect entry fees for the vessel and has no direct bearing on the cargo carrying capacity of the vessel.)

c. *Units of Distance and Speed.*

(1) *Distance.* Nautical mile=6,080 feet.

(2) *Speed.* Knot=1 nautical mile per hour.

d. *Gross Tonnage.* Gross tonnage (gross register tonnage) is the entire internal cubic capacity of a ship expressed in register tons of 100 cubic feet each.

e. *Net Tonnage.* Net tonnage (net register tonnage) of a ship represents the cargo and passenger earning spaces which remain after deduction from the gross tonnage of space for the crew, power plant, fuel, and operation of the vessel. Net tonnage is expressed in tons of 100 cubic feet each.

f. *Deadweight Tonnage.* Deadweight tonnage is the carrying capacity of a ship expressed in long tons and represents the difference between displacement loaded to maximum draft allowed by law and displacement light.

g. *Displacement Tonnage Light.* Displacement tonnage light is the weight of a ship in long tons and excludes the weight of cargo, passengers, fuel, water, stores, dunnage, and such other items necessary for use on a voyage.

h. *Displacement Tonnage Loaded.* Displacement tonnage loaded is the weight of a ship in long tons and includes the weight of cargo,

passengers, fuel, water, stores, dunnage, and such other items necessary for use on a voyage.

i. Cargo Deadweight Tonnage. Cargo deadweight tonnage is the weight-lifting capacity of a ship in long tons, remaining after deducting from the deadweight tonnage the weight of fuel, water, stores, dunnage, and such other items as may be necessary for a voyage.

j. Grain Cubic Capacity. Grain cubic capacity is the maximum space available for cargo measured in cubic feet, the measurements being taken to the inside of the shell plating of the ship or to the outside of the frames and to the top of the beams or under side of the deck plating. If a bulk cargo of grain were loaded, it would flow in between the frames and beams and occupy the maximum space available. This is the grain cubic capacity.

k. Bale Cubic Capacity. Bale cubic capacity of a ship is the number of cubic feet of space available for cargo measured to the inside of the cargo battens, on the frames, and to the underside of the beams.

l. Lost Space. Lost space (broken stowage, stowage loss) is the difference between the ship's cubic measurement and the total measurement of the cargo. It varies in vessels carrying military cargo according to the type of loading employed. Combat loaded vessels may have approximately 50 percent lost space. Lost space in normal loading ranges from 10 to 20 percent.

m. Stowage Factor. A stowage factor is a relationship of cubage to weight. As applied to cargo, it is the ratio of the number of cubic feet of space occupied by the cargo to the weight of the cargo in long tons. The units in which a stowage factor is expressed are stated as "cubic feet per long ton." In individual items or types of cargo, it is the amount of cubic feet of space occupied by one long ton.

n. Vessel Stowage Factor. Vessel stowage factor = (bale cubic capacity—estimated lost space) ÷ (cargo deadweight tonnage—estimated weight of deck cargo).

- (1) *Example problem:* To determine whether weight or volume of a specific commodity will be the limiting factor in loading a Liberty type ship of 400,000 cubic feet capacity after deducting lost space and with a cargo capacity tonnage (less deck load) of 8,000 long tons.

$$\begin{aligned}\text{Vessel factor} &= \frac{400,000 \text{ cubic feet}}{8,000 \text{ long tons}} \\ &= 50 \text{ cubic feet/long ton}\end{aligned}$$

- (2) Under the conditions stated above, the vessel will have its cargo space completely filled and its weight capacity utilized if stowed with cargo occupying 50 cubic feet to the

long ton. In this example for cargo occupying more than 50 cubic feet per long ton, volume will be the limiting factor. For cargo occupying less than 50 cubic feet per long ton, weight will be the limiting factor.

241. Definitions of Shipping Terminals

a. Wharf. A wharf is a projecting platform of timber, stone, or other material which extends into water deep enough for vessels to be accommodated alongside for loading or unloading.

b. Quay. A quay is a wharf parallel with the shoreline of a basin or harbor with water and accommodations for ships on one side only.

c. Pier. A pier is a wharf which projects into the harbor or basin with water and accommodations for ships on both sides.

242. Unit Loading Methods

a. Combat Loading. Combat loading is the loading of an assault troop unit together with its essential combat equipment and initial combat supplies in a single ship and in such a manner as to permit immediate and rapid debarkation in a desired priority for landing attack.

b. Unit Loading. Unit loading is the loading of a troop unit together with its equipment and supplies on the same ship but without consideration of priority of debarkation for landing attack. It permits debarkation of complete units and equipment available for employment after assembly ashore. This method is more economical in ship space than combat loading.

c. Convoy Loading. Convoy loading is the loading of troop units with their equipment and supplies on ships of the same convoy, but not necessarily the same ship. Units so loaded are available for employment when landed at established beachheads or ports and after the lapse of time necessary to assemble them on land with their equipment and supplies.

243. Commercial Loading Methods

a. Bulk and General Cargo Loading. Bulk and general cargo loading is the stowage of supplies to utilize the entire carrying capacity of a ship disregarding segregation of cargoes either by class, technical service, or commodity. It permits maximum economy in shipping space but requires additional labor and facilities at destination for segregation and assembly of supplies for use.

b. Multiple Port Discharge. Multiple port discharge utilizes bulk stowage of supplies for more than one destination loaded so as to maintain availability for discharge of proper items in the order of arrival at the ship's scheduled destinations.

244. Special Military Loading

a. Commodity Loading. Commodity loading is the loading of a ship with one class of supply or with supplies of a single service. This method makes less efficient use of shipping space but permits discharge and clearance of supplies from a port area without delay for segregation.

b. Balanced Loading. Balanced loading is utilized in loading a vessel in quantities proportional to expected or estimated rates of consumption or needs for a specific number of personnel.

c. Selective Loading. Selective loading is the loading of supplies and equipment in a vessel in such a manner that specific items may be discharged on call.

d. Combinations. Special loading methods may be used in combination to produce desired results. Example: Balanced class V ship loaded for selective discharge.

245. Nomenclature of Maritime Commission Oceangoing Vessels

Note.—There is such a large difference in the cubic carrying capacity of vessels of the same type because of various alterations and special fittings, that the cubic feet and tonnage figures shown in the following tables are, in most instances, minimum and apply to one type of the designated vessels only.

Type	Deadweight tonnage	Remarks
B7	5,083	Concrete hull, cargo barge, nonpropelled.
C1A	7,416	Designed for general cargo in world trade, steam turbine and motor propelled (4 modifications).
C1B	9,100	Designed for general cargo in world trade, steam turbine and motor propelled (4 modifications).
C1M	5,000	Designed for general cargo, motor propelled.
C1S	5,310	Concrete barge designed for cargo purposes, steam-reciprocating-engine propelled.
C2	8,514	Designed for general cargo in world trade, steam turbine propelled (several modified types); prefixed by the symbol "Z" were in operation during the war. Modified types were used mostly as hospital ships.
C3	9,937	Combination passenger and cargo ship, steam turbine propelled (several modified types).
C3	12,929	Designed for cargo, steam turbine propelled.
C4	13,200	Designed for cargo, steam turbine propelled (2 modifications).
C4	14,600	Designed for troops, steam turbine propelled (2 modifications).
EC2	10,800	Liberty type designed for general cargo; steam-reciprocating-engine propelled. Several modified types, prefixed by the symbol "Z" were designed as tank carriers and later modified as plane carriers.
L6	15,580	Specially designed for coal or grain trade on the Great Lakes steam-reciprocating-engine propelled.
N3	2,905	Cargo carrier designed for coastal trade, steam-reciprocating-engine propelled.
P1	1,877	Specially designed passenger-type vessel, steam turbine propelled.
P2	8,759	Designed to carry troops. Two types, one turbine-electric propelled, one steam turbine propelled.
T1	1,483	Designed for tanker service in coastal and inland waters, Diesel propelled (5 modifications).
T2	16,765	Designed to carry bulk oil in world trade, turbo-electric propelled (2 modifications).
T3	18,333	Designed to carry bulk oil in world trade, steam turbine propelled (3 modifications).
V2	100	Diesel-powered tug for general towing purposes.
V4	786	Large Diesel-powered oceangoing tug.
VC2	10,820	Victory type designed to carry cargo in world trade. Three types, one has 6,000 HP engine, two have 8,500 HP engines. All three are steam turbine propelled.

246. Vessel Planning Data—General Characteristics

Vessel Planning Data—General Characteristics Capacity ^a

Type loading	Vessel type	Type cargo ^b	Troops	Cargo (including vehicles) ^c
Combat.....	APA	Combat equipment.....	1,300	700
Combat.....	AKA	Combat equipment.....	200	2,000
Combat.....	LSD	Combat equipment.....	250	^d 1,650
Combat.....	LST	Combat equipment.....	150	^e 560
				^f 1,428
Combat.....	LSM	Combat equipment.....	50	^g 165
				^h 316
Convoy.....	AK	Combat equipment.....		5,000
Convoy.....	AP	Combat equipment.....	2,000	700
Comm.....	Victory.....			5,600
	Troop.....		2,000	
	Tanker bulk POL.....			140,000 barrels

^a Capacities given are for planning purposes only and should be used only when specific vessels assigned are unknown.

^b Average troop ship is considered to have sufficient cargo capacity for personal equipment and baggage of its rated passenger load.

^c Cargo capacity is in short tons and includes the weight of vehicles when loaded but does not include weight of troops with their personal equipment and baggage.

^d With no temporary decking typical load is 3 LCU or 18 LCM (6) or 41 LVT or 47 amphibious trucks. With temporary decking a load of 64 LVT or 74 amphibious trucks may be carried.

^e Combat load for beaching.

^f Heavy loaded not intended for beaching purposes.

^g Capacity to lift M26 and M45 tanks: LSD-9; LST-10; LSM-4.

247. Cargo Vessel Characteristics

a. Physical Characteristics.

	1	2	3	4	5	6	7
1	Vessel	Gross register tonnage	Over-all length (ft)	Beam (ft)	Sustained speed (knots)	Cruising radius (naut mi)	Summer draft (ft)
2	Liberty.....	7,100	442	57	11.0	¹ 9,000	28
3	Victory.....	7,600	455	62	15.5	18,000	29
4	C1 B Cargo.....	6,700	418	60	14.0	16,000	28
5	C2 Cargo.....	6,058	459	63	15.0	16,000	26
6	C3 Cargo.....	7,950	492	70	16.5	12,000	29
7	C4 Cargo.....	11,500	520	71	15.0	16,000	33
8	FS Freighter ²	560	176	32	12.0	3,556	10
9	C1 M AV 1 Freighter.....	3,860	339	50	11.0	10,600	23
10	T2E Tanker.....	10,200	524	68	14.5	13,000	30
11	ZET 1 Tanker ³	7,000	442	57	11.5	17,000	28

¹ Cruising radius can be increased to 18,000 miles if deep tanks are used for fuel oil. See footnote 2 in c below.

² FS type (freight service ship) is the 176-foot vessel built for the Army. It is an oceangoing vessel but, because of its small capacity, is used principally as an interisland carrier.

³ Converted Liberty.

RESTRICTED—Security Information*b. Hold, Hatch, and Boom Data.*

	1	2	3	4	5	6
1	Vessel	Cargo holds (number)	Boom capacity (LT)	Booms (number)	Capacity heavy lift rigs (LT)	Hatches w/ heavy lift booms (by number)
2	Liberty.....	5	5	12	1 50-15	2-4
3	Victory.....	5	5	18	1 50-30	1 3-4
4	C1 B Cargo.....	5	5	17	30	2
5	C2 Cargo.....	5	5	15	30	3
6	C3 Cargo.....	5	5-10	17	30	5
7	C4 Cargo.....	7	5	24	50	4-5
8	FS Freighter ¹	2	5	4	15	2
9	C1 M AV 1 Freighter.....	4	11½ 5	12	30	2-3
10	T2E Tanker.....	9	5	-----	5	-----
11	ZET 1 Tanker ²	9	5	-----	5	-----

¹ Some Liberties have a 30-ton boom at No. 2 hatch; all have 15-ton booms at No. 4. All Victories have 30-ton booms at No. 4 hatch.

² FS type (freight service ship) is the 176-foot vessel built for the Army. It is an oceangoing vessel but, because of its small capacity, is used principally as an interisland carrier.

³ Converted Liberty.

c. Vessel Capacities.

	1	2	3	4	5	6	7
1	Vessel	Dead-weight (LT)	Meas. tons ^{1 2}	Bale cubic capacity (cu ft) ^{1 2}	Grain cubic capacity (cu ft) ¹	Ref. cargo (cu ft)	Liquid cargo (bbls)
2	Liberty.....	10,800	11,500	460,000	535,000	-----	5,000
3	Victory.....	10,600	11,750	470,000	523,000	-----	-----
4	C1 B Cargo.....	9,100	11,400	456,000	499,000	-----	-----
5	C2 Cargo.....	9,722	12,600	504,000	638,000	-----	-----
6	C3 Cargo.....	12,200	13,350	534,000	672,000	32,890	-----
7	C4 Cargo.....	15,000	16,000	640,000	829,000	-----	-----
8	FS Freighter.....	340	483	19,320	-----	-----	-----
9	C1 M AV 1 (Coaster).....	5,010	5,640	225,600	250,000	9,830	4,000
10	T2E Tanker.....	16,760	375	-----	-----	-----	141,000
11	ZET 1 Tanker ³	10,800	-----	-----	-----	-----	65,000

¹ On-deck space or lost space in stowage not included.

² Does not include capacity of deep tanks of which the Liberty type ship has 3. Deep tanks No. 1 and No. 2 with approximately 16,000 cubic feet of capacity may be used for dry or liquid cargoes if not in use for vessel voyage requirements. No. 3 deep tank is rigged for either fuel oil or bulk cargo liquids. A 5,000 barrel (703 LT) payload can be shipped in this tank if the contemplated voyage is to be short enough that No. 3 tank will not be needed for fuel oil.

³ Converted Liberty.

d. Detailed Capacities Below Deck.

	1	2	3	4	5	6
1	Ship type	Hatch number	Hatch dimensions	Cargo capacities in measurement tons		
				Hold	'Tween deck	Deep tanks
2	Liberty.....	1	33 ft. 9 in. x 20 ft..	900	1,000	140
3	.....	2	35 ft. 0 in. x 20 ft..	2,300	1,100	270
4	.....	3	20 ft. 0 in. x 20 ft..	1,500	600	460
5	.....	4	35 ft. 0 in. x 20 ft..	1,300	700	.....
6	.....	5	35 ft. 0 in. x 20 ft..	1,300	800	.....
7	Total.....	.....	.....	7,300	4,200	870

	1	2	3	4	5	6	7
1	Ship type	Hatch number	Hatch dimensions	Cargo capacities in measurement tons			
				Hold	Upper 'tween deck	Lower 'tween deck	Deep tanks
2	Victory ¹	1	22 ft. 4 in. x 25 ft..	698	468	595	0
		2	22 ft. 4 in. x 24 ft..	699	675	545	0
		3	22 ft. 4 in. x 36 ft..	1,321	1,139	945	0
		4	22 ft. 4 in. x 36 ft..	1,278	1,230	0	1,047
		5	22 ft. 4 in. x 33 ft..	648	1,091	0	367
	Total.....	.....	.....	4,644	4,603	2,085	1,414
3	O 1 B ¹	1	27 ft. 0 in. x 20 ft..	581	571	429	166
		2	31 ft. 6 in. x 20 ft..	1,195	904	778	0
		3	31 ft. 6 in. x 20 ft..	1,102	977	785	233
		4	31 ft. 6 in. x 20 ft..	0	974	1,085	0
		5	27 ft. 0 in. x 20 ft..	0	644	470	0
	Total.....	.....	.....	2,878	4,070	3,547	399
4	ZEC-5 ¹	1	40 ft. 0 in. x 20 ft..	1,334	1,472	0	143
		2	40 ft. 0 in. x 20 ft..	1,676	1,357	1,642	272
		3	40 ft. 0 in. x 20 ft..	1,226	1,073	0	244
		4	20 ft. 0 in. x 20 ft..	500	0	0	606
	Total.....	.....	.....	4,736	3,902	1,642	1,265

¹ Capacities given for the 3 vessels mentioned here are averages of loading reports and reflect varying lost space factors. For overall planning not related to specific vessel loadings, use data in c above.

² Known as the "focsele."

RESTRICTED—Security Information

e. Composition of Deadweight Tonnage. With the addition of the ZEC 5, a modified Liberty ship for use in shipment of planes or other bulky cargo, four types comprise the majority of all shipping available for military use. Further detailed data for these vessels follow.

It is to be noted that ships' capacities are expressed in long tons in order to agree with normal shipping procedures, whereas the discharge and loading capabilities of Transportation Corps Port Companies are expressed in short tons in order to agree with practices of other modes of transportation.

	1	2	3	4
1	Vessel	Maximum ship-operating supplies*	Cargo capacity tonnage when operating supplies are maximum*	Total
2	Liberty.....	2,800 LT	8,000 LT	10,800 LT
3	Victory.....	3,100 LT	7,500 LT	10,600 LT
4	C1B.....	1,850 LT	7,250 LT	9,100 LT
5	ZEC-5.....	3,770 LT	5,430 LT	9,200 LT

*Operating supplies include fuel, water, dunnage, and ship stores. A additional payload capacity may be substituted to a limit dependent on length of voyage and character of cargo which will warrant a reduction in such ship-operating supplies.

f. Vehicle Loading Capacities.

	1	2	3	4	5	6	7	8	9	10	11
1	Type of ship	Trucks ¼-ton ¹		Trailers 1-ton ¹		Comd and Ren cars ¾-ton ¹		Trucks, 1½ ton 4 x 4 ¹		Trucks, 2½ ton 6 x 6, (LWB) ¹	
		On wheels	Crated ²	On wheels	Crated ²	On wheels	Crated ²	On wheels	Crated ²	On wheels	Crated ²
2	Liberty.....	498	2,078	404	4,493	312	744	214	607	185	357
3	Victory.....	512	1,983	512	4,287	331	710	278	579	193	340
4	C1B.....	511	1,912	491	4,133	330	684	276	558	179	328
5	ZEC-5.....	493	1,748	402	3,800	301	629	215	513	163	302

¹ Double the number of ¼-ton trucks on wheels can be stowed if they are stacked. It also is estimated that at least 35 percent more 1-ton trailers can be loaded if stowed in tandem with drawbar nested inside body of preceding trailer, provided tail gates are drop type. Regarding the other three types of vehicles, more can be stowed in the Liberty ship by double-decking; see note to C1B table in *g* below.

² All crated vehicles are hoisted by single units except the 1-ton trailers which are hoisted by twin units.

³ 153 ¼-ton trucks may be loaded in the bodies of 153 of these trucks. The other 32 trucks will not take jeeps because of the limiting height of the compartments in which stowed. As an alternative, a total of 215 trucks can be stowed by double decking in No. 2 and No. 3 holds.

g. Detailed Vehicle Loading Capacities (stowed on wheels).

C 1 B*						
1	2	3	4	5	6	7
Hatch No.	Location	Jeeps	Trailers 1-ton	Comd and Ren cars ¾-ton	Trucks 1½-ton 4 x 4	Trucks 2½-ton 6 x 6 LWB
1	On deck.....	14	14	12	8	5
	Upper 'tween deck.....	21	18	12	10	6
	Lower 'tween deck.....	21	18	12	10	6
	Lower hold.....	14	13	9	6	3
2	On deck.....	25	21	18	16	12
	Upper 'tween deck.....	46	37	25	22	13
	Lower 'tween deck.....	42	37	25	22	15
	Lower hold.....	34	36	21	20	13
3	On deck.....	23	21	14	16	10
	Upper 'tween deck.....	44	42	30	22	17
	Lower 'tween deck.....	41	42	28	21	13
	Lower hold.....	41	42	28	21	13
4	On deck.....	21	21	14	14	10
	Upper 'tween deck.....	39	41	26	21	14
	Lower 'tween deck.....	36	37	24	19	12
	On deck.....	16	18	12	12	7
5	Upper 'tween deck.....	23	23	15	12	7
	Lower 'tween deck.....	10	10	5	4	3

*Number of vehicles in lower holds of No. 2 and No. 3 hatches can be doubled by flooring over one layer of vehicles and loading a second layer directly on top. The depth of only these two holds will permit such double-decking.

Liberty Ship								
1	2	3	4	5	6	7	8	9
Hatch No.	Location	Jeeps	Trailers 1-ton	Comd and Ren cars ¾-ton	Trucks 1½-ton 4 x 4	Trucks 2½-ton 6 x 6 LWB	Wpns carr ¾-ton 4 x 4	Pers carr 1½-ton 6 x 6
1	On deck.....	22	22	14	10	9	14	10
	'Tween deck.....	28	27	23	15	12	23	17
	Lower hold.....	28	24	18	14	10	18	12
	On deck.....	41	36	20	14	13	20	16
2	'Tween deck.....	54	44	30	23	21	30	24
	Lower hold.....	48	42	*30	*20	*18	*30	*20
	On deck.....	22	14	10	9	6	10	6
	'Tween deck.....	36	28	25	16	14	25	17
3	Lower hold.....	32	28	*22	*14	*12	*22	*14
	On deck.....	31	20	16	12	11	16	12
	'Tween deck.....	41	37	27	18	16	27	21
	Lower hold.....	20	15	18	8	10	18	10
4	On deck.....	31	22	14	14	11	14	14
	'Tween deck.....	44	34	25	20	16	25	20
	Lower hold.....	20	11	20	7	6	20	10

*Based on no center-line bulkhead which may or may not be standard equipment.

RESTRICTED—Security Information*g. Detailed Vehicle Loading Capacities (stowed on wheels).—Con.*

Victory Ship*

1	2	3	4	5	6	7
Hatch No.	Location	Jeeps	Trailers 1-ton	Comd and Ren cars ¾-ton	Trucks 1½-ton 4 x 4	Trucks 2½-ton 6 x 6 LWB
1	On deck.....	14	12	6	5	5
	Upper 'tween deck.....	15	16	9	8	5
	Lower 'tween deck.....	16	18	9	10	6
	Hold.....	15	13	8	7	4
2	On deck.....	18	16	12	11	7
	Upper 'tween deck.....	29	26	17	15	10
	Lower 'tween deck.....	25	24	17	15	10
	Hold.....	21	21	14	12	8
3	On deck.....	25	29	18	18	13
	Upper 'tween deck.....	48	48	29	26	17
	Lower 'tween deck.....	46	46	30	25	18
	Hold.....	44	46	30	25	18
4	On deck.....	23	25	18	18	13
	'Tween deck.....	49	48	34	23	16
	Hold.....	49	49	31	24	18
	On deck.....	25	25	17	11	6
5	'Tween deck.....	30	31	20	15	12
	Hold.....	20	19	12	10	7

* There are no available aircraft data for the Liberty, Victory, and C 1 B ships, since their holds are not adaptable to plane stowage, and consequently they were seldom used for this purpose.

ZEC-5

1	2	3	4	5	6	7
Hatch No.	Location	Jeeps	Trailers 1-ton	Comd and Ren cars ¾-ton	Trucks 1½-ton 4 x 4	Trucks 2½-ton 6 x 6 LWB
1	On deck.....	28	21	15	14	7
	'Tween deck.....	46	40	30	22	18
	Hold.....	42	43	29	21	17
	On deck.....	26	21	15	14	9
2	Upper 'tween deck.....	70	58	43	28	23
	Lower 'tween deck.....	81	60	45	31	24
	Hold.....	66	59	46	33	26
	On deck.....	26	19	15	10	9
3	'Tween deck.....	60	42	33	22	16
	Hold.....	48	39	30	20	14

h. The ZEC-5, a modified EC-2 (Liberty ship) is fitted with hatches larger than on ordinary Liberty ships, thereby permitting under-deck stowage of certain types of assembled aircraft in addition to those carried on deck.¹ Typical aircraft loading capacity by hatches is as follows:

Hatch No.	Location	Type of aircraft			
		P-51 ²	P-47D ²	P-47N ²	P-80 ³
1	On deck.....	5	4	4	4
	'Tween deck.....	6	4	4	-----
	Hold.....	5	3	3	-----
2	On deck.....	5	4	4	4
	Upper 'tween deck.....	9	5	3	9
	Lower 'tween deck.....	9	5	4	8
	Hold.....	8	5	4	7
3	On deck.....	5	4	4	4
	'Tween deck.....	6	3	3	5
	Hold.....	5	3	3	3
4	On deck.....	2	1	1	1
Total per ship.....		65	41	37	45

¹ There are no available aircraft loading data for the Liberty, Victory, and C 1 B ships, since their holds are not adaptable to plane stowage, and consequently they were seldom used for this purpose.

² With propellers, wing tips, and stabilizers removed.

³ Totals on P-80 aircraft are based on loading of one vessel. The tail section(s) is boxed and a large box is required for each unit; all of number 1 between deck and hold are filled with boxed tail section(s) and motors.

248. Approximate Sailing Distances in Nautical Miles

Ports	Ports of Embarkation						
	Boston	New York	Charleston	New Orleans	Los Angeles	San Francisco	Seattle
<i>United States</i>							
Boston.....		200	900	2,000	15,100	15,400	16,200
New York.....	200		600	1,700	14,900	15,300	16,000
Charleston.....	900	600		1,200	14,500	14,900	15,600
New Orleans.....	2,000	1,700	1,200		14,300	14,700	15,500
Los Angeles.....	15,100	14,900	14,500	14,300		400	1,100
San Francisco.....	15,400	15,300	14,900	14,700	400		800
Seattle.....	16,200	16,000	15,600	15,500	1,100	800	
<i>North Atlantic</i>							
Newfoundland,							
St. Johns.....	900	1,100	1,700	2,600	15,700	16,000	16,800
Greenland, Ivigtut...	1,700	1,900	2,400	3,400	16,500	16,800	17,600
Iceland, Reykjavik...	2,300	2,500	3,000	4,000	17,100	17,400	18,200
<i>European</i>							
United Kingdom:							
Liverpool.....	3,000	3,200	3,700	4,700	17,600	17,900	18,700
Southampton.....	3,000	3,200	3,600	4,600	17,500	17,800	18,600
Northern Ireland,							
Belfast.....	2,900	3,000	3,400	4,400	17,200	17,500	18,300
Norway, Oslo.....	3,900	4,100	4,400	5,300	18,200	18,600	19,400
Russia:							
Archangel.....	4,000	4,200	4,800	5,800	18,800	19,200	110,000
Murmansk.....	3,700	3,800	4,400	5,400	18,500	18,900	19,700
France:							
Le Havre.....	3,000	3,200	3,600	4,600	17,500	17,800	18,600
Brest.....	2,900	3,100	3,500	4,500	17,400	17,700	18,500
Bordeaux.....	3,000	3,200	3,700	4,700	17,600	17,900	18,700
Belgium, Antwerp...	3,200	3,400	3,800	4,800	17,700	18,000	18,800
<i>Mediterranean</i>							
France, Marseille...	23,700	23,900	24,300	25,300	18,000	18,200	19,000
Italy, Naples.....	24,000	24,200	24,600	25,600	18,300	18,500	19,300
Algeria, Algiers.....	23,400	23,600	24,000	25,000	17,700	18,000	18,800
St. of Gibraltar.....	3,000	3,200	3,600	4,600	17,300	17,500	18,300
<i>Caribbean and South Atlantic</i>							
Bermuda, Hamilton...	700	700	800	1,700	14,600	14,900	15,800
Puerto Rico, San Juan.....	1,500	1,400	1,100	1,500	13,900	14,300	15,100
Trinidad, Port of Spain.....	2,000	1,900	1,700	2,100	14,100	14,400	15,300
Brazil, Rio de Janeiro.....	4,700	4,800	4,700	5,200	17,200	17,600	18,400
Argentina, Buenos Aires.....	5,800	5,900	5,800	6,300	18,300	18,700	19,600
Panama Canal, Panama.....	2,200	2,000	1,600	1,400	2,900	13,200	4,000
<i>Middle East</i>							
Egypt, Port Said.....	24,900	25,100	25,500	26,500	19,200	19,500	110,300
Arabia, Aden.....	26,300	26,500	26,900	27,900	110,600	110,900	111,700
Turkey, Istanbul.....	24,800	25,000	25,400	26,400	19,100	19,400	110,200
Persia, Basra.....	28,300	28,500	28,900	29,800	112,600	112,900	113,700

See footnotes at end of table.

248. Approximate Sailing Distances in Nautical Miles—Continued

Ports	Ports of Embarkation						
	Boston	New York	Charles-ton	New Orleans	Los Angeles	San Francisco	Seattle
<i>North Pacific</i>							
Alaska, Dutch Harbor.....	1 7, 400	1 7, 300	1 6, 900	1 6, 700	2, 400	2, 100	1, 700
<i>Middle Pacific</i>							
Hawaiian Islands, Honolulu.....	1 6, 900	1 6, 700	1 6, 300	1 6, 100	2, 200	2, 100	2, 400
Marshall Islands, Kwajalein.....	1 9, 200	1 9, 000	1 8, 600	1 8, 400	4, 200	4, 410	4, 500
Marianas Islands, Guam.....	1 10, 200	1 10, 000	1 9, 600	1 9, 400	5, 600	5, 100	4, 900
Japan, Yokohama....	1 9, 900	1 9, 600	1 9, 500	1 9, 100	4, 800	4, 500	4, 200
<i>South West Pacific</i>							
New Guinea, Finscbhafen.....	1 10, 200	1 10, 000	1 9, 600	1 9, 400	6, 100	5, 900	6, 000
Philippine Islands, Manila.....	1 11, 600	1 11, 300	1 11, 000	1 10, 800	6, 600	6, 300	6, 100
Australia:							
Brisbane.....	1 9, 900	1 9, 600	1 9, 300	1 9, 100	6, 300	6, 200	6, 500
Melbourne.....	1 10, 100	1 9, 900	1 9, 500	1 9, 400	7, 000	7, 000	7, 300
East Indies, Singapore.....	2 9, 900	1 10, 100	2 10, 500	2 11, 500	7, 900	7, 500	7, 100
<i>China-India-Burma</i>							
Cbina:							
Shanghai.....	1 10, 800	1 10, 600	1 10, 200	1 10, 000	5, 700	5, 400	5, 100
Hongkong.....	1 11, 400	1 11, 200	1 10, 800	1 10, 600	6, 400	6, 000	5, 700
India:							
Bombay.....	2 8, 000	2 8, 200	2 8, 600	2 9, 500	1 2 12, 200 10, 300	1 2 12, 600 9, 900	1 2 13, 400 9, 500
Calcutta.....	2 9, 600	2 9, 800	2 10, 200	2 11, 200	1 2 13, 900 9, 500	1 2 14, 200 9, 100	1 2 15, 000 8, 700
Burma, Rangoon....	2 9, 600	2 9, 800	2 10, 200	2 11, 200	1 2 13, 900 8, 000	1 2 14, 200 8, 600	1 2 15, 000 8, 200
East Russia, Vladivostok.....	1 9, 500	1 9, 300	1 8, 900	1 8, 700	5, 000	4, 600	4, 400

1 Via Panama Canal.

2 Via Strait of Gibraltar.

249. Shipping Turn-Around Times

a. General. Turn-around time for like type ships seldom will be the same between two ports, or other equidistant runs, unless sailings are carefully controlled. Assuming controlled operating conditions, a basis for turn-around times can be established for type ships (troop or cargo) for general planning purposes.

b. Turn-Around Time Components. Turn-around time components are—

- (1) Loading time at home port.
- (2) Steaming time to and from destination.
- (3) Unloading and loading time at destination.
- (4) Unloading time at home port.
- (5) Normal voyage repair and reoutfitting time.

c. Planning Factors.

- (1) Sailing distances per day:¹

Cargo Ships:

Slow—240 nautical miles.

Fast—360 nautical miles.

Passenger Ships:

Slow—360 nautical miles.

Fast—432 nautical miles.

- (2) Time in ports per round trip for unloading, loading, voyage repairs and reoutfitting.

Cargo ships—39 days.

Troop ships—25 days.

Tankers—13 days.

- (3) Convoys and effect on turn-around time. A major portion of shipping may be conducted in convoy formation, the speed of which is dictated by the slowest vessel in each convoy. This factor must be considered when computing turn-around time for convoy or *escorted* shipping.

¹ For convoy sailing speed of advance deduct 10 percent for delays in forming convoys, zigzagging en route, etc. The 10 percent loss factor is not applicable to ships in the "Fast" category since such ships will normally proceed individually.

d. Table.

Ports	Ports of Embarkation*													
	Boston		New York		Charleston		New Orleans		Los Angeles		San Francisco		Seattle	
	Type of shipping													
	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo
United States														
Boston.....									48	72	50	74	54	82
New York.....									46	70	49	74	53	80
Charleston.....									45	67	47	71	51	77
New Orleans.....									44	67	46	69	51	77
Los Angeles.....	48	72	40	70	45	67	44	67						
San Francisco.....	50	74	49	74	47	71	46	69						
Seattle.....	54	82	53	80	51	77	51	77						
North Atlantic														
Nowfoundland, St. John.....			27	40	30	45	36	53	55	82	57	85	61	92
Greenland, Ivigtut.....	30	45	31	47	35	52	41	61	60	89	62	92	66	100
Iceland, Reykjavik.....	34	50	35	52	38	57	44	67	63	95	65	97	70	100
European														
United Kingdom:														
Liverpool.....	38	57	39	59	43	64	49	73	66	100	68	102	73	110
Southampton.....	38	57	39	59	42	63	48	72	66	99	68	102	72	109
Northern Ireland, Belfast.....	38	56	38	57	41	61	47	70	64	96	60	99	71	106
Norway, Oslo.....	44	66	45	68	47	70	52	78	70	105	72	109	77	116
Russia:														
Archangel.....	44	67	46	69	49	74	55	83	73	111	76	114	81	122
Murmansk.....	43	64	43	65	47	70	53	80	72	108	74	112	79	119
See footnote at end of table.														

See footnote at end of table.

RESTRICTED

427

RESTRICTED—Security Information

249

d. Table—Continued

Ports	Ports of Embarkation*													
	Boston		New York		Charleston		New Orleans		Los Angeles		San Francisco		Seattle	
	Type of shipping													
	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo
France:														
Le Havre.....	38	57	39	59	42	63	48	72	66	99	68	102	72	109
Brest.....	38	56	39	58	41	62	48	71	65	97	67	101	72	108
Bordeaux.....	38	57	39	59	43	64	49	73	66	100	68	102	73	110
Belgium, Antwerp.....	39	59	41	61	43	65	49	74	67	101	69	103	73	111
Mediterranean														
France, Marseillo.....	43	64	44	66	46	69	52	78	69	103	70	106	75	113
Italy, Naples.....	44	67	46	69	48	72	54	81	71	106	72	108	77	115
Algeria, Algiers.....	41	61	42	63	44	67	50	76	67	101	69	103	73	111
Straits of Gibraltar.....	38	57	39	59	42	63	48	72	65	97	66	99	71	106
Caribbean and South Atlantic														
Bermuda, Hamilton.....							30	45	48	72	50	75	55	83
Puerto Rico, San Juan.....	29	44	28	42	27	40	29	44	44	66	46	69	50	76
Trinidad, Port of Spain.....	32	48	31	47	30	45	33	49	45	68	47	70	52	78
Brazil, Rio de Janeiro.....	49	73	49	74	49	73	51	78	64	96	66	100	71	107
Argentina, Buenos Aires.....	55	83	56	84	55	83	59	88	71	106	73	110	78	118
Panama, Panama Canal.....	33	48	32	48	30	45	28	42	38	56	39	59	44	67
Middle East														
Egypt, Port Said.....	50	75	50	76	54	80	60	89	76	114	78	117	83	124
Arabia, Aden.....	51	78	60	89	62	92	68	102	85	127	86	130	92	137
Turkey, Istanbul.....	49	74	50	76	53	80	59	89	76	113	77	116	82	124
Persia, Basra.....	71	106	72	108	73	110	80	120	97	145	99	147	104	155

<i>North Pacific</i>														
Alaska, Dutch Harbor.....	65	97	65	97	62	93	61	91	35	52	33	49	30	45
<i>Middle Pacific</i>														
Hawaiian Islands, Honolulu.....	62	93	61	91	59	88	57	86	33	48	33	49	35	52
Marshall Islands, Kwajalein.....	76	114	75	113	72	109	71	107	46	69	47	70	48	71
Marianas, Guam.....	82	124	81	122	78	118	77	116	54	81	50	76	50	75
Japan, Yokohama.....	80	121	79	118	78	117	76	113	49	74	48	71	46	69
<i>Southwest Pacific</i>														
New Guinea, Finschhafen.....	82	124	81	122	78	118	77	116	57	86	56	84	57	85
Philippines, Manila.....	91	136	89	133	87	131	86	129	60	90	59	88	57	86
Australia:														
Brisbane.....	80	121	78	118	77	115	76	113	59	88	58	87	60	89
Melbourne.....	82	123	80	121	78	117	77	116	62	94	62	94	65	97
East Indies, Singapore.....	80	121	82	123	83	126	90	134	68	102	66	99	63	95
<i>China-India-Burma</i>														
China:														
Shanghai.....	86	129	85	127	82	124	81	122	55	82	53	80	50	76
Hongkong.....	90	135	88	132	86	129	85	127	59	89	57	85	55	82
India:														
Bombay.....	69	103	70	106	72	109	78	117	94	142	97	145	102	153
Calcutta.....	79	118	80	120	82	124	88	132	83	124	80	121	78	117
Canton.....									105	157	108	160	112	167
Rangoon.....									78	117	76	113	73	110
Burma, Rangoon.....	79	118	80	120	82	124	88	132	165	157	108	160	112	167
Singapore.....									75	113	72	109	70	106
East Russia, Vladivostok.....	78	117	77	115	74	112	73	110	50	76	48	72	47	70

*All turn-around times are based on the routes indicated in the table in par. 248 and on data given in c above. The turn-around times between ports with the exception of inter-U. S. port times includes a 10 percent safety factor for forming convoy zigzagging, etc.

CHAPTER 8

LOGISTICS—SERVICE

Section I. GENERAL

250. Coverage

This section contains information of and measurement factors involved in the services other than supply.

251. Cross References

a. Troop requirements for all services are found in paragraphs 47 through 53.

b. Characteristics of ordnance and chemical weapons are found in paragraphs 62 and 63.

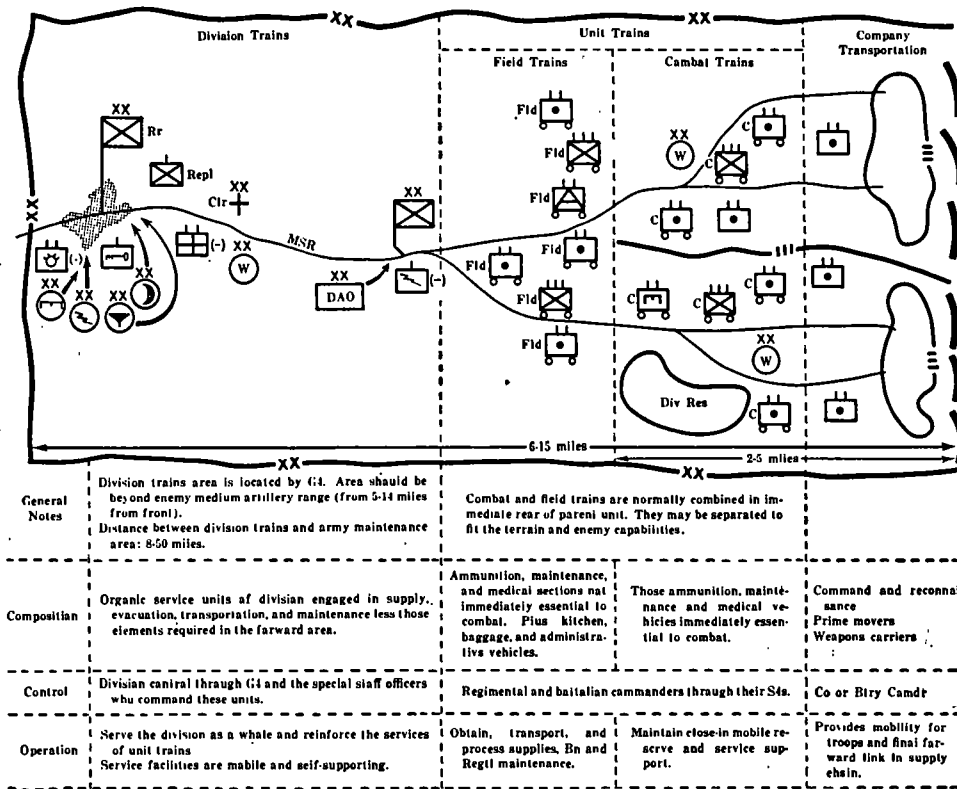
c. Tactical signal communication is covered in paragraphs 64 through 71.

d. Field engineering is covered in paragraphs 72 through 79.

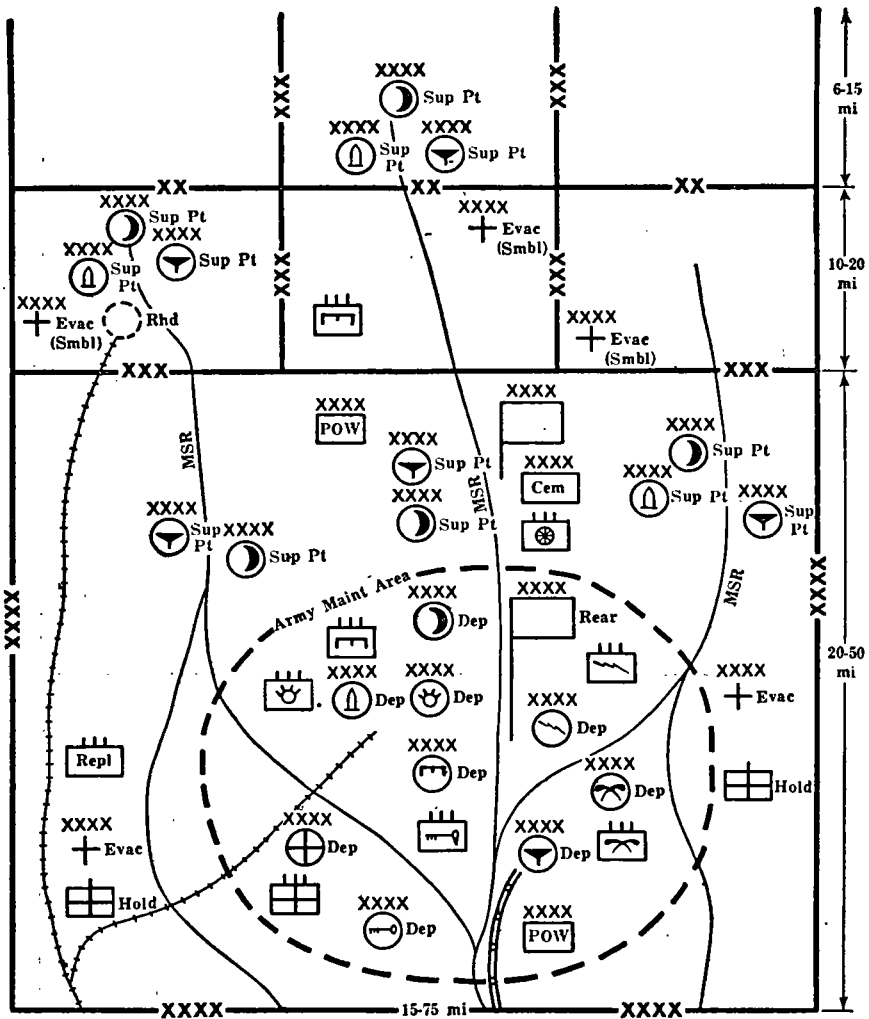
e. Characteristics of material of all services are covered in chapter 5.

f. Pipe-line data, in addition to that in this section, are found in paragraphs 91, 94, and 184 through 185.

252. Division Service Installations



The disposition, composition, and functions of any element may be modified from that shown to fit the terrain and the tactical or administrative situation.

253. Army Service Installations**Section II. ENGINEER****254. Construction Troops**

a. Battalion Month. One battalion month is the construction effort of an average experienced and properly equipped Engineer Construction Battalion during 1 month of time. For general estimates the battalion month represents 90,000 man-hours of construc-

tion effort. This factor is based on the following assumed conditions:

- (1) The net construction strength of an average engineer construction unit is 60 percent of its T/O & E strength. The remaining 40 percent represents unit maintenance, administrative and command personnel and individuals not available for duty.
- (2) Sixty-five percent of the construction time is productive. The remaining 35 percent represents construction time lost due to adverse weather, job to job moves, enemy action, shortage of supplies, and similar time loss factors.
- (3) Each man normally works 10 hours per day, 6 days per week.
- (4) Two-shift operation is employed for construction equipment, allowing 4 hours for change of shift and maintenance of equipment.

b. Force Estimates. The force estimates outlined herein are based on average conditions encountered in the various theaters during World War II. They should be used only as a general planning guide and should be modified for known or expected conditions of particular operations.

c. Unit Equivalents. It is not practicable to state an average factor for construction effort of the various other engineer units, based on the battalion month yardstick, as defined in *a* above, which will be applicable to all types of construction projects. The quantity and type of equipment assigned to the unit and its training are important factors in determining its effectiveness on a particular type of construction work. For example, an Engineer Combat Battalion would be more effective than an Engineer Construction Battalion in the repair of roads in a combat zone (average factor 1.3), but an Engineer Combat Battalion would be much less effective than an Engineer Construction Battalion in the construction of a new road in the communications zone, requiring considerable earth moving (average factor 0.6). The below listed factors are based on the assumption that, in general, the average construction project in a combat zone requires much less heavy engineer equipment than the average construction project in a communications zone. The factors apply only to properly equipped engineer units of average experience. They should be used only in broad planning and do not apply to any one particular construction project. The many factors involved make it advisable that an experienced engineer officer, familiar with the technical details of a particular project, determine the type of engineer unit to be assigned to its construction, whenever practicable.

1	1	2	3
	Unit	Average construction effort factor	
		Combat zone	Communications zone
2	Engr Cons Bn.....	1.0	1.0
3	Engr Combat Bn	1.3	.6
4	Engr Avn Bn	.9	1.2
5	Engr Combat Bn plus Lt Equip Co.....	1.4	.9
6	Engr Cons Bn plus Hvy Equip Co.....	1.2	1.4

255. Roads*a. Road Nets.*

- (1) Construction and maintenance of roads in a theater of operations is held to the minimum required by the situation and is based on maximum use of the existing road net. The capacity of roads of various types, in short tons forward per day (t/d) is given in paragraph 218.
- (2) Normally the minimum road nets to be provided and maintained are as follows:

(a) In the combat zone—

1. One 500 t/d road per front line division forward of corps rear boundary.
2. One 2,000 t/d road and one 500 t/d road per corps forward of army rear boundary.
3. Lateral roads at 10-mile intervals in rear of division rear boundary, alternately 2,000 t/d and 500 t/d.
4. Access roads as required at depots, supply points, and other installations in corps and army service areas.

(b) In the communications zone—

1. One 2,000 t/d and one 500 t/d road from each major port to each army service area. Where only one port serves an army or a task force composed of a reinforced corps, a minimum of one 2,000 t/d and two 500 t/d roads.
2. Access roads as required at depots and other installations in the communications zone.

b. New Construction of Roads.

- (1) Construction policy. New road construction is undertaken only where absolutely necessary and normally it includes only such items as detours to bypass demolitions, and access roads. The factors below are given primarily for estimating rehabilitation as a percentage of the requirements for new construction.

- (2) Bridge and culvert requirements. For planning purposes it is assumed that 1 mile of new road requires 40 lineal feet of bridging and 7 culverts.
- (3) Material requirements for 1 mile of new road including bridges, culverts, asphalt and cement but no gravel nor aggregate.

1	1	2	3	4	5
	Type of road	Surface 12' wide		Surface 22' wide	
		Short tons	Measurement tons	Short tons	Measurement tons
2	Dirt.....	35	36	64	74
3	Gravel surface.....	51	58	100	117
4	3" asphalt surface.....	81	95	170	203
5	4" concrete surface.....	200	130	423	280
6	6" concrete surface.....	300	180	638	386

Note.—Bridging as in (6) below except that bridging for dirt roads is assumed to be 75 percent timber and 25 percent steel stringers on timber substructures.

- (4) Gravel requirements for 1 mile of new road.

1	1	2	3	4	5
	Type of road	Surface 12' wide		Surface 22' wide	
		Cubic yards	Short tons	Cubic yards	Short tons
2	Gravel surface 4" thick*.....	782	1,173	1,434	2,151
3	Gravel surface 5" thick*.....	978	1,466	1,793	2,690
4	Gravel surface 6" thick*.....	1,174	1,761	2,151	3,226
5	3" asphalt surface.....	587	881	1,076	1,614
6	4" concrete surface.....	782	1,174	1,434	2,151

*Based on loose thickness. For compacted thickness, add 25 percent.

- (5) Corrugated metal culvert pipe requirements per mile of road, based on 30 lineal feet per culvert for roads 12 feet wide, 56 lineal feet for roads 22 feet wide, and 7 culverts per mile of road.

RESTRICTED—Security Information

	1	2	3	4	5	6	7	8	9
1		Size inches, diameter	Percent	Surface 12 feet wide			Surface 22 feet wide		
				Linear feet	Weight, pounds	Cubic feet	Linear feet	Weight, pounds	Cubic feet
2	Average quantities for cul- vert.	18	15	4.5	72	1.22	8.4	134	2.27
3		24	25	7.5	157	2.78	14.0	294	5.18
4		36	30	9.0	333	7.38	16.8	629	13.94
5		42	7	2.1	134	2.31	3.9	256	4.40
6		48	15	4.5	324	6.35	8.4	605	11.84
7		60	8	2.4	264	6.00	4.5	495	11.25
8	Total.....		100	30.0	1,284	26.04	56.0	2,413	48.88
9	Quantities per mile.....			210.0	8,988	182.28	392.0	16,891	342.16
10		Short tons.....		4.49			8.44		
11		Measurement tons.		4.56			8.55		

NOTES

1. Example. 100 miles of 12-foot road requires 100 x 4.5 or 450 lin. ft. of 18-inch pipe, which is enough for 15 culverts. Total requirements for all sizes amount to 449 short tons, 456 measurement tons.
2. Estimate culvert installation at 5 man-hours per lineal foot or 1,050 man-hours per mile of 12-foot road, 1,960 man-hours per mile of 22-foot road.

(6) Fixed bridge requirements per mile of road, based on 40 lineal feet of bridge per mile of road and on average percentages of the various types of structures.

	1	2	3	4	5	6	7	8	9
1	Type of structure	Unit length, feet	Percent of 40 lineal feet	12 feet wide			22 feet wide		
				Short tons	Measure- ment tons	Man- hours	Short tons	Measure- ment tons	Man- hours
2	Timber.....	14-20	35	9.31	9.55	127	17.22	19.95	185
3	I-Beam H-35.....	30	25	9.46	11.36	210	18.92	22.72	420
4	I-Beam H-35.....	60	15	10.08	10.14	200	20.16	20.28	400
5	Thru Truss H-35.....	90	3½	3.26	3.75	48	6.52	7.50	96
6	Deck Truss H-20.....	125	9½	8.38	11.20	70	16.76	22.40	140
7	Through Truss Bailey D. D.	130	12	5.64	7.88	74	11.28	15.76	148
8	Total.....		100	46.13	53.88	729	90.86	108.61	1,389

NOTES

1. Timber bridge data, line 2 of table, is based on typical bridge having 3 14-foot spans of wood stringers and 2 20-foot spans of steel stringers.
2. The quantities are based on timber and wood pile substructures. If the planning includes steel trestle piers for 60 to 150 foot spans, add 0.500 short tons, 0.375 measurement tons, and 7½ man-hours per lineal foot of bridge for 12-foot width; double these quantities for 22-foot width.
3. Semipermanent highway steel bridges (lines 3, 4, and 5; see TM 5-285).

(7) Highway bridge construction.

(a) Types, capacities, and references.¹

	1	2	3	4
1	Type ²	Span	Capacities	References
2	I-Beam, H-35.....	30-foot...	75-ton with caution.....	TM 5-286
3	I-Beam, H-35.....	60-foot.....	75-ton with caution.....	TM 5-286
4	Truss, H-35.....	90-foot.....	Maximum of 70-ton with caution.....	TM 5-286
5	Bailey.....	30 to 180-foot.	18- to 70-ton depending on type and length of span.....	TM 5-277 TM 5-286

¹ Based on single-lane bridging.² Refer to TM 5-285 and TM 5-277 for descriptions and details of construction.

(8) Construction effort, in net effective man-hours of engineer construction troops, required to grade and surface 1 mile of new road. (See note 2 below table.)

	1	2	3	4	5	6	7	8
1	Terrain	Surface 12 feet wide			Grad- ing	Surface 22 feet wide		
		Grad- ing	Surface			Surface		
			4-inch gravel	6-inch gravel		4-inch gravel	6-inch gravel	5-inch gravel, 3- inch asphalt
2	Flat-Prairie.....	2, 500	5, 000	5, 600	3, 500	6, 500	7, 200	20, 800
3	Rolling.....	3, 000	6, 200	7, 000	4, 000	7, 600	8, 300	22, 100
4	Hilly-Forested.....	4, 700	8, 300	9, 200	5, 500	10, 000	10, 500	25, 000
5	Mountain-Forested—no rock.....	8, 400	12, 300	13, 200	22, 000	26, 700	27, 500	42, 800
6	Mountain—some rock.....	14, 000	18, 400	19, 500	36, 500	47, 000	51, 500	62, 000
7	Mountain—heavy rock.....	26, 500	36, 000	38, 400	70, 000	80, 500	85, 000	95, 500

NOTES

1. Based on pit-run gravel except lines 6 and 7, which are based on crushed rock.

2. The tabulated man-hours do not include bridges and culverts. Add 1,800 man-hours for 12-foot and 3,350 man-hours for 22-foot, for bridges and culverts as given in (5) and (6) above.

c. Road Rehabilitation. Materials and effort required to rehabilitate roads after action, in percentages of the materials and effort required for new construction.

	1	2
1	Rehabilitation of	Equivalent percentages of new construction (percent)
2	Roads.....	10 to 20.
3	Culverts.....	15.
4	Bridges.....	50 to 75.

d. Road Maintenance. After rehabilitation and not allowing for further damage in action, suitably trained and equipped engineer troops maintain roads on the basis of 15 man-hours net effective effort per mile of road per day.

e. Policy for Roads and Bridge Construction.

- (1) *Responsibility.* Between combat and communications zone, bridging is normally on an area basis. Communications zone forces take over all bridging operations in rear of the army area as rapidly as possible. All rearward elements assume bridge maintenance in forward areas as soon as the situation permits. Rearward engineer units are charged with replacing tactical and other portable types of bridging with non-portable types as quickly as possible, strengthening bridging to carry successively heavier loads, and for such bridge removal as the situation justifies.
- (2) *General bridge policy.* Tactical bridging is normally placed by divisional engineers. Organizational equipment will be replaced as quickly as possible by rearward engineers with heavier bridging. Stocks of fixed and floating Bailey bridge, H-10 bridge, Type H-35 bridge, and timber trestle bridge with steel beams are available in depots for use in the communications zone and also in the combat zone where time and the tactical situation permit. Bailey bridging will be utilized by forward units where practicable. Replaced and surplus bridging is returned to depots.

256. Railway Construction

a. New Construction.

- (1) The railroad division used in planning includes 100 route miles of main line, single or double track, together with its terminal operating and maintenance facilities, fueling and watering facilities as required, and the necessary signaling equipment or interlocking facilities for safe operation. Passing sidings on single track lines, stations, and crossovers at double track lines at stations, are at intervals as required by the traffic. Normally at least one spur or siding is provided at each station.

- (2) Materials and man-hours (net effective) required for new construction of 1 mile of standard gage (4'8½"), single track railroad.

	1	2	3	4
1	Item	Short tons	Measure- ment tons	Man-hours
2	Grading.....			1 5, 000
3	Ballast Production.....			2 2, 500
4	Track Laying and Surfacing.....			3 3, 400
5	Bridging—70 lin. ft.....	91	90	2, 400
6	Culverts—7.....	6	6	1, 300
7	Ties—2,600.....	170	195	
8	Rail—75 lb.....	132	42	
9	Fastenings (based on 33 feet rail).....	27	8	
10	Total.....	426	341	14, 600

¹ Includes clearing and is based on average wooded terrain.

² Includes hauling a reasonable distance.

³ Allows 400 man-hours per mile for placing ties. Allow for any additional time needed to haul ties.

- (3) Materials and man-hours (net effective) required for new construction of a typical 100-mile standard gage (4'8½") single track division.¹

	1	2	3	4	5	6	7
1	Item	Miles	Quantity	Turn- outs ⁷	Short tons	Measure- ment tons	Man- hours
2	Grading ²	100.0					500, 000
3	Ballast production.....	100.0					250, 000
4	Main line track ³				15, 900	5, 000	300, 000
5	Ties, (8" x 9" x 8').....		260, 000		17, 000	19, 500	40, 000
6	Sidings.....	4.5	18	36	1, 880	1, 500	21, 200
7	Station trackage ⁴	3.0	12	24	1, 087	876	14, 400
8	Port trackage ⁵	3.0		24	1, 087	876	14, 400
9	Railway terminal.....	20.0	1	150	10, 700	6, 500	160, 000
10	Railhead trackage ⁶	.5	2	4	209	166	3, 200
11	Water stations ⁴		3		135	210	9, 000
12	Coal and inspection facilities.....		1		19	16	900
13	Culverts (7 per mile).....		700		600	600	130, 000
14	Bridging (70' per mile) ⁸				9, 100	9, 000	240, 000
15	Contingencies ⁹				583	456	16, 000
16	Total.....			238	58, 300	44, 700	1, 700, 000

¹ See FM 5-10 for definitions, descriptions of installations, and details.

² Includes clearing and is based on average wooded terrain.

³ Based on 75-pound rail and include angle bars, spikes and other fastenings. Man-hours include ballast-ing, lining and surfacing.

⁴ Include 25,000 gallon tank, standpipe and 1,200 feet of water pipe per station.

⁵ Assumes 70 linear feet per mile of various types, some with steel trestles, some with pile and timber bents (TM 5-286).

⁶ Adds about 1 percent using arbitrary figures which round out the totals.

⁷ Include switch ties and switch stands.

b. Rehabilitation.

- (1) Normally railroad demolition is heaviest near ports of entry, lighter inland. This is reflected in the table below, which gives rehabilitation requirements for a 100-mile division extending inland from a port, using high percentages of demolition for the first 30 miles, lower ones for the next 70 miles. For planning purposes, still lower percentages of demolition may be assumed for lines farther than 100 miles inland.¹

	1	2	3	4	5	6
	0 to 30 miles from the port ¹					
1	Item and quantities	Demolition (percent)	Rehabilitation (quantity)	Materials		Man-hours
				Short tons	Measurement tons	
2	Main line, 30 miles.....	20	6.0	954	300.	31,200
3	Port trackage, 12, 3 miles ²	100	3.0	1,368	1,092	14,400
4	Passing sidings, 6, 1.5 miles ²	80	1.2	547	437	5,800
5	Station sidings, 4, 1.0 miles ²	80	.8	365	291	3,800
6	Railway terminal, 1 ²	75	.75	8,025	4,875	160,000
7	Bridging, 2,100 linear feet.....	75	1,575.0	1,575	1,500	46,200
8	Culverts, 210.....	15	32.0	27	27	5,900
9	Grading.....					17,000
10	Ballast.....					21,200
11	Ties, main line, 30 miles.....	6	1.8	310	360	
12	Total.....			13,171	8,882	305,400
	30 to 100 miles inland					
13	Main line, 70 miles.....	10	7.0	1,113	350	36,400
14	Passing sidings, 12, 3 miles ²	80	2.4	1,049	874	11,500
15	Station sidings, 8, 2 miles ²	80	1.6	730	582	7,700
16	Regulating station ²		1.0	7,205	5,754	140,000
17	Water stations, 3.....	100	3.0	135	210	9,000
18	Fuel station, 1.....	100	1.0	21	18	1,000
19	Bridging 4,900 linear feet.....	55	2,700.0	2,700	2,672	70,000
20	Culverts, 490.....	15	74.0	63	63	13,700
21	Grading.....					18,000
22	Ballast.....					22,500
23	Ties, main line, 70 miles.....	5	3.5	595	693	
24	Total.....			13,656	11,206	329,800

¹ Tunnels require special consideration. To repair (by timbering) a 50-foot demolition at each end of a single-track tunnel (100' total per tunnel), allow 70 short tons, 87 measurement tons, and 3,000 man-hours.

² Estimate includes ties, rails, fastenings, turnouts, and track laying and surfacing. It assumes ballast is available at work sites.

³ Includes replacement of buildings 100 percent, ties 30 percent, rail and turnouts 85 percent.

⁴ Provides minimum requirements for replacement buildings, rail and turnouts 100 percent, ties 85 percent, man-hours 100 percent of new construction.

¹ Reference: FM5-10 for definitions and specifications.

- (2) Items and man-hours (net effective) required for rehabilitation of a typical 100-mile standard gage (4' 8½") single track division further than 100 miles inland.

	1	2	3	4	5	6	7
	Item	Miles track	Number	Turn-outs	Demolition (percent)	Rehabilitation	Man-hours
2	Main line.....	100			10	10 miles....	59,000
3	Sidings.....	7.5	30		10	0.7 mile....	4,100
4	Sidings.....			60	75	45.....	6,800
5	Terminal.....	20			50	10 miles....	59,000
6	Terminal.....			150	80	120 miles....	18,000
7	Terminal water station.....		1		100	1 mile.....	6,000
8	Terminal Eng House.....		1		100	1 mile.....	6,000
9	Terminal fuel station.....		1		100	1 mile.....	1,000
10	Wayside water station.....		3		100	3 miles....	9,000
11	Wayside fuel and inspection station.....		1		100	1 mile.....	1,000
12	Bridging—7,000 linear feet:						
	Major, 4,000 linear feet.....				75	3,000 L. F.	69,000
	Minor, 3,000 linear feet.....				35	1,000 L. F.	14,000
13	Culverts.....		700		15		19,500
14	Railhead.....	.5		4	100	0.5 mile....	3,600
15	Grading main line.....						20,000
16	Grading sidings.....						1,000
17	Contingencies about 10 percent.....						28,000
18	Regulating station.....						140,000
19	Total.....						465,000

257. Port Construction

a. Approximate Planning Factors. The following planning factors give the materials and man-hours required for port facilities adequate for the handling of 720 short tons of discharged dry cargo per day of 20-hour operation. This is a convenient unit because it is the wharf discharge rate of one ship, Liberty type, as given in paragraph 231*d*. The facilities include ship or lighterage wharf space, access road from wharf to road net, and minimum covered and open storage. Of the four factors given, Cases I and II are based on new wharf construction, the others on rehabilitation.

RESTRICTED—Security Information

- (1) *Case I.* New construction of 500 linear feet of deep-draft marginal wharf (par. 231), and port facilities for 720 short tons per day.¹

1	1	2	3	4
	Item	Short tons	Measure- ment tons	Man-hours
2	Timber pile marginal wharf, 500' x 60'-----	1,200	2,000	15,000
3	0.7 mile of access road, asphalt surfaced, 22' wide-----	65	80	14,000
4	2 miles of railroad including sidings ¹ -----	675	500	14,500
5	10,000 square feet covered storage ² -----	65	45	1,800
6	60,000 square feet open storage-----			50
7	Total-----	2,005	2,625	45,350

¹ Based on 75-pound rail and upon normal requirements for service and yard tracks and for terminal car storage.

² Based on shell-type insulated warehouses (par. 280*m*) with 3-inch concrete floors.

- (2) *Case II.* New construction of 350 linear feet of marginal lighterage wharf (par. 231) and port facilities for 720 short tons per day.

1	1	2	3	4
	Item	Short tons	Measure- ment tons	Man-hours
2	Timber pile marginal wharf 350' x 35'-----	600	800	8,400
3	0.7 mile of access road, asphalt surfaced 22' wide-----	65	80	14,000
4	2 miles of railroad including sidings ¹ -----	675	500	14,500
5	10,000 square feet covered storage ¹ -----	65	45	1,800
6	60,000 square feet open storage-----			50
7	Total-----	1,405	1,425	38,750

¹ Notes 1 and 2, Case I, apply also to Case II.

¹ If site conditions favor finger type piers 500 feet by 90 feet, 2 berths per pier, the above factors *per berth* continue to apply.

- (3) *Case III.* Rehabilitation of 500 linear feet of deep draft wharf, clearance of debris, and new construction of other port facilities for 720 short tons per day.

	1	2	3	4
1	Item	Short tons	Measure- ment tons	Man-hours
2	Repair of 500 linear feet of deep-water wharf ¹	1, 375	2, 190	25, 000
3	0.7 mile of access road, asphalt surface 22' wide.....	65	80	14, 000
4	2 miles of railroad including sidings ²	675	500	14, 500
5	10,000 square feet covered storage ²	65	45	1, 800
6	60,000 square feet open storage.....			50
7	Clearing debris ²			2, 500
8	Total.....	2, 180	2, 815	57, 850

¹ Based on repair of cratered wharf faces by timber and V-trestle construction to a width of 60 feet.

² Notes 1 and 2, Case I, apply also to Case III.

³ Based on 10 percent of the man-hours in line 2.

- (4) *Case IV.* Rehabilitation of 350 linear feet of lighterage wharf, clearance of debris, and new construction of other port facilities for 720 short tons per day.

	1	2	3	4
1	Item	Short tons	Measure- ment tons	Man-hours
2	Repair of 350 linear feet of lighterage wharf ¹	580	920	10, 500
3	0.7 mile of access road, asphalt surface 22' wide.....	65	80	14, 000
4	2 miles of railroad including sidings ²	675	500	14, 500
5	10,000 square feet covered storage ²	65	45	1, 800
6	60,000 square feet open storage.....			50
7	Clearing debris ²			1, 100
8	Total.....	1, 385	1, 545	41, 950

¹ Based on repair of cratered wharf faces by timber or steel sheet pile.

² Notes 1 and 2, Case I; and Note 3, Case III, apply also to Case IV.

b. Construction Rate for Pile-and-Timber Wharves. Normally, one engineer construction company constructs 500 linear feet of deep-draft marginal wharf, or equivalent, in about 6 days. These rates cannot be improved by using a force larger than a company on one wharf structure of these sizes, due to the sequences necessary in pile driving, capping, bracing, and deck construction.

c. Demolition of Existing Facilities. Experience in the invasion of developed harbors indicates the average percentages of demolitions to be anticipated are as tabulated below. In addition, the removal of

sunken wrecks or blockships may be required; normally 2 or 3 in a small harbor, 10 to 20 in a large one. If the harbor entrance is narrow, it is usually found blocked.

	1	2
1	Facilities	Average demolition
2	Permanent wharves or quays.....	30 percent very badly damaged; early repair impracticable. 30 percent heavily damaged; much debris; reasonably early repair possible. 40 percent lightly damaged, less debris, early repair practicable.
3	Port cranes.....	100 percent destroyed.
4	Port warehouses.....	50 percent to 100 percent destroyed.

d. Utilities Required at Ship Wharves.

(1) *Fresh water.* With pressures normal in municipal water supply, one 4-inch pipeline with three 2½-inch outlets refills a Liberty ship's capacity of 115,000 gallons in 6 hours.

(2) *Illumination.* Five-hundred-watt incandescent lamps, mounted 35 feet above the wharf deck and spaced at intervals of 120 feet, provide adequate illumination averaging 1 to 2 foot-candles.

e. Construction Factors for Specific Types of Deep-Draft Wharves and Approaches. The following information is based on details in TM 5-280, using wood piles and timber deck.

	1	2	3	4
1	Type of wharf	Short tons	Measurement tons	Man-hours
2	Finger pier 500' x 90', 60' piles, no railway.....	2, 230	3, 780	30, 700
3	Finger pier 500' x 90', 60' piles, with railway.....	2, 255	3, 960	33, 150
4	Finger pier 500' x 90', 80' piles, no railway.....	2, 600	4, 490	32, 650
5	Finger pier 500' x 90', 80' piles, with railway.....	2, 755	4, 725	35, 225
6	Marginal wharf 500' x 60', 60' piles, no railway.....	1, 095	1, 825	12, 800
7	Marginal wharf 500' x 60', 60' piles, with railway.....	1, 160	1, 915	14, 080
8	Marginal wharf 500' x 60', 80' piles, no railway.....	1, 250	2, 120	13, 600
9	Marginal wharf 500' x 60', 80' piles, with railway.....	1, 315	2, 210	14, 960
10	Wharf approaches 30' wide (per 100 linear feet) no railway.....	103	182	2, 050
11	Wharf approaches 30' wide (per 100 linear feet) with railway.....	120	195	2, 180

f. Construction Factors for Specific Types of Marginal Lighterage Wharves, per 100 Linear Feet.

	1	2	3	4
	Type of construction	Short tons	Measurement tons	Man-hours
2	Timber pile, 35 feet wide, using 40 foot piles.....	171	228	2,400
3	Timber crib, supporting timber bents, 35 feet wide.....	143	193	2,800
4	Timber retaining wall (Wakefield pile) with earth or rubble fill.....	21	30.5	1,300
5	Steel sheet piling retaining wall with earth or rubble fill.....	27	25	1,100

g. Construction Factors for Floating Ponton Wharves. Reference—Pontoon Gear Manual, Rev March 1944, Bureau of Yards and Docks, Dept. of the Navy. A floating wharf suitable for a Victory or Liberty ship berth is 7 pontoons wide by 72 pontoons long, or about 50 by 420 feet. Three approaches, each 4 by 24 pontoons, about 28 by 140 feet, are usually adequate. Total area of wharf and approaches is 32,760 sq. ft. The construction factors are—

	1	2	3	4
	Floating pontoon wharves	Short tons	Measurement tons	Man-hours
2	Per 1,000 square feet.....	42	127	343
3	Wharf and approaches as above, 32,760 square feet.....	1,376	4,160	11,240

h. Construction Details for LST Landings. Top surfaces of landings are 25 feet wide; side slopes 1:4. Landings extending to a depth of 5 feet at low water are adequate except on beaches flatter than 1:50.

258. Dredging

a. Since dredging is a slow operation, dredging harbors in a military operation should be avoided if possible. Likewise, because of the danger of damaging foundations, plans should not anticipate dredging in the close proximity of quay walls. Generally demolition debris can be cleared in front of berthing sites by the use of dragline or clam-shell cranes. If dredging of harbor areas is unavoidable the following overall planning factors may be used as a guide. Dredging quantities vary considerably with the type of equipment used, the distance of haul to the spoil area, the method of haul, and the kind of material being excavated (sand, mud, gravel, soft rock or coral, hardrock, etc.)

	1	2	3	4	5
1	Type of dredge	Hydraulic suction ¹	Dipper	Clam shell or orange peel	Sea-going ² hopper
2	Size.....	12"-28" pipe.....	2-16 cubic yards....	1-9 cubic yards....	700-5,000 cubic yards.
3	Operating personnel.	Varies from 12-90 man crews, depending on size of dredge and number of shifts being worked			
4	Operating characteristics and principal use.	Soft digging, river channel dredging.	Clay, rock, or debris excavation.	Dredging in limited areas, caisson work, debris clearance.	Outer harbor work. Spoil area may be several miles away.
5	Maximum swells affecting operations.	3'.....	10'.....	10'.....	Designed for dredging in rough water.
6	Maximum dredging depth (feet).	15'-65'.....	20'-50'.....	10'-60'.....	38'-60'.
7	Average daily capacity ³ (cubic yards.)	5,400 (12'')..... 28,000 (28'').....	2,000 (2 CY)..... 9,000 (16 CY).....	500 (1 CY)..... 3,000 (9 CY).....	6,500 (700 CY). 10,000 (5,000 CY).

¹ The average distance which this type of dredge pumps to a spoil area is 1,000-3,000 feet. On the Fort Peck Dam the 28" dredge pumped 11,000-31,000 feet.

² Dredges normally require 1 day per week shut down for maintenance. These figures do not include maintenance delays but do include time consumed in moving the dredge along the cut area.

³ The 700-cubic yard "Hoffman Type" dredge was designed for use in World War II. It is especially useful in cutting a channel across a shoal at a harbor entrance. In a military operation it is probable that all other dredging would be accomplished with local equipment or on-site expedients.

259. General Construction

a. General. This paragraph presents planning factors for engineer materials and man-hours required for construction of facilities in the following categories.

- (1) Troop housing.
- (2) Headquarters and administration facilities.
- (3) Hospitals.
- (4) Depots.
- (5) Shops.
- (6) Refrigeration and ice plants.
- (7) Personnel service buildings, including laundries, dry cleaning plants, bakeries, recreation facilities and base post offices.
- (8) POW camps.

b. Troop Housing.

- (1) *Types.* Normally troop units bivouac without assistance, but troop housing is constructed when and as justified. Troop housing facilities are estimated in six types intended for varying degrees of permanence. These types are as follows:
 - (a) *Type 1.* T/O & E tents—no engineer materials nor assistance.
 - (b) *Type 2.* Class IV tents pitched by using troops—no engineer materials nor assistance.
 - (c) *Type 3.* Frame buildings for administration, bathhouses, infirmaries, storehouse, and kitchens. Class IV tents (with 2" concrete floors in housing only) for all other purposes. Access road stabilized with local materials. Water piped from central storage tank to bathhouses and kitchens. Electric distribution to buildings. Pit latrines.
 - (d) *Type 4.* Frame buildings for all purposes except housing, for which there are class IV tents with 2" concrete floors and wooden frames. Electric distribution to all facilities. Other utilities same as type 3 above.
 - (e) *Type 5.* Frame buildings for all purposes; otherwise the same as type 4 above.
 - (f) *Type 6.* Frame buildings for all purposes, latrines replaced by plumbing and waterborne sewage (disposal plant not included in estimates); and bituminous surface for access road. Otherwise the same as type 5 above. This type includes all applicable facilities described in TM 5-280.

RESTRICTED—Security Information

- (2) *Material and man-hour requirements* for the various types, for camps in the temperate climate, in sizes from 250- to 3,000-man. Structures will be primarily prefabricated buildings for all climates. Standard framing, T. O. construction based on TM5-280 will be used as an alternative.

	1	2	3	4	5	6	7	8	9	10	11
	Type	Size (number men)	Structures, 1,000 square feet		Electric (kva.)	Water M gal/ day	Roads in miles	Site area (acres)	Short tons	Measure- ment (tons)	Man- hours
			Buildings	Tents							
2	1	Organic tents—No engineer materials nor effort required.									
3	2	Class IV QM tents erected by using service. No engineer materials nor effort required.									
4	3	250	5.4	14.0	5	5.0	0.20	10	78	72	2,700
5		500	12.0	28.0	5	10.0	.20	20	156	133	4,300
6		1,000	24.00	56.0	10	15.0	.25	35	260	217	7,700
7	3	1,500	30.0	83.0	15	22.5	.25	50	361	302	11,990
8		3,000	62.0	166.0	30	45.0	.50	75	733	612	21,300
9		250	11.0	12.0	5	5.0	.40	10	168	171	8,460
10	4	500	22.0	23.0	5	10.0	.40	20	307	321	13,600
11		1,000	41.0	46.0	10	15.0	.50	35	544	561	20,700
12		1,500	54.0	68.0	15	22.5	.50	50	745	755	25,860
13	5	3,000	112.0	136.0	30	45.0	1.00	75	1,522	1,542	52,220
14		250	24.0	0	5	5.0	.40	10	246	270	10,200
15		500	45.0	0	5	10.0	.40	20	441	487	16,900
16	5	1,000	85.0	0	10	15.0	.50	35	843	945	27,400
17		1,500	123.0	0	15	22.5	.50	50	1,225	1,355	36,700
18		3,000	246.0	0	30	45.0	1.00	75	2,472	2,730	72,000
19	6	250	25.0	0	5	6.25	.40	10	288	347	18,000
20		500	47.0	0	5	12.5	.40	20	548	639	26,900
21		1,000	86.0	0	10	25.0	.50	35	951	1,091	38,100
22	6	1,500	123.0	0	15	37.5	.50	50	1,340	1,540	49,590
23		3,000	246.0	0	30	75.0	1.00	75	2,702	3,100	95,700

c. Headquarters and Administration Facilities.

- (1) *Types.* Estimates are based on two types, type 5 and type 6, with specifications the same as for troop housing of these types.
- (2) *Material and man-hour requirements* for the above types, for headquarters requiring office space between 10,000 and 50,000 square feet, for various climates. Structures will be primarily prefabricated buildings for all climates. Stand-

ard frame T. O. construction based on TM 5-280 will be used as an alternative.

	1	2	3	4	5	6	7	8	9	10
1	Type	Climate	Size office space (M sq. ft.)	Other space (M sq. ft.)	Elec- tric (kva.)	Water (gpd.)	Roads (miles)	Materials		Man- hours
								Short tons	Meas- ure- ment (tons)	
2	5	Temperate.....	10	5	15	200	0.5	141	150	8,150
3			25	7	30	500	1.0	315	329	17,120
4			50	14	45	1,000	2.0	626	648	33,990
5		Tropic.....	10	5	15	200	.5	121	120	7,800
6			25	7	30	500	1.5	273	267	16,370
7			50	14	45	1,000	2.0	543	524	32,120
8		Frigid.....	10	5	15	200	.5	279	404	14,610
9			25	7	30	500	1.5	597	857	38,490
10			50	14	45	1,000	2.0	1,192	1,712	60,840
11		6	Temperate.....	10	5	15	3,000	.5	203	232	16,765
12	25			7	30	8,000	1.0	442	496	34,510
13	50			14	45	15,000	2.0	878	977	67,330
14	Tropic.....		10	5	15	3,000	.5	181	182	16,415
15			25	7	30	8,000	1.0	400	434	33,760
16			50	14	45	15,000	2.0	795	855	65,860
17		Frigid.....	(Data not available.)							

d. Hospitals.

(1) *Types.* Estimates are based on three types of construction, similar in permanence to troop housing of types 2, 4, and 6, respectively, as follows:

(a) *Type 2.* All facilities in organic and Class IV tents, hospital tents floored and framed, personnel tents pitched by using troops with no engineer materials nor assistance. Water piped from central storage tank to necessary facilities; roads unimproved; pit latrines.

(b) *Type 4.* Buildings for all facilities except hospital wards and personnel housing, for which concrete tent floors and wood tent frames are provided. Facilities include a 1-ton ice plant but no laundries nor refrigerated warehouses. Estimates include stabilized roads, water and electric distribution, plumbing and waterborne sewage, but do not include sewage disposal plant.

(c) *Type 6.* Buildings and utilities complete for all facilities, as described in TM 5-280. Bituminous surfaced roads are included.

(2) *Material and man-hour requirements* for 300- to 1,000-bed hospitals of the above types, for various climates and types of buildings.

(a) 300-bed hospital.

	1	2	3	4	5	6	7	8	9	10	11	12
	Type	Buildings (sq. ft.)	Tent floors (sq. ft.)	Electric (kva.)	Water (gal. per day)	Roads (miles)	Site area (acres)	Type of buildings	Climate	Materials		Man- hours
										Short tons	Measure- ment tons	
2	2	-----	41,000	15	15,000	0.5	20	-----	-----	118	85	4,950
3	4	38,000	32,000	50	30,000	.75	20	Shell	Tropic	660	880	34,000
4								Temperate	Temperate	710	955	34,840
5								Prefabricated	Tropic	656	787	30,694
6								Frame	Temperate	706	868	31,534
7	6	85,000	-----	100	30,000	.75	20	TOpns	Tropic	1,140	1,485	54,200
8								Shell	Temperate	990	1,350	46,090
9								TOpns	Tropic	1,082	1,441	54,180
10								Frame	Temperate	1,191	1,605	56,000
11	6	85,000	-----	100	30,000	.75	20	Prefabricated	Tropic	1,184	1,467	47,945
12								Frame	Temperate	1,182	1,375	48,605
13								TOpns	Tropic	1,870	2,437	88,600
14								Frame	Temperate	1,655	2,269	78,120
15								TOpns	Frigid	2,165	2,917	90,000

RESTRICTED

451

(b) 400-bed hospital.

	1	2	3	4	5	6	7	8	9	10	11	12
	Type	Buildings (sq. ft.)	Tent floors (sq. ft.)	Electric (kva.)	Water (gal. per day)	Roads (miles)	Site area (acres)	Type of buildings	Climate	Materials		Man- hours
										Short tons	Measure- ment tons	
2	2	-----	45,000	50	20,000	0.75	25	-----	-----	133	122	7,290
3								Shell -----	Tropic -----	755	1,069	42,040
4								-----	Temperate -----	821	1,168	43,700
5	4	51,000	37,000	100	40,000	1.0	25	Prefabricated -----	Tropic -----	800	1,074	37,287
6								-----	Temperate -----	816	1,031	39,590
7								Frame -----	Tropic -----	1,279	1,704	67,200
8								TOpns -----	Temperate -----	1,190	1,060	60,500
9								Shell -----	Tropic -----	1,516	2,045	72,500
10								-----	Temperate -----	1,658	2,267	75,000
11								Prefabricated -----	Tropic -----	1,626	2,056	64,500
12	0	109,000	-----	200	40,000	1.0	25	-----	Temperate -----	1,647	1,972	65,500
13								Frame -----	Tropic -----	2,558	3,408	115,000
14								TOpns -----	Temperate -----	2,412	3,341	103,000
15								-----	Frigid -----	2,958	4,071	120,000

RESTRICTED—Security Information

259

(c) 500-bed hospital.

1	1	2	3	4	5	6	7	8	9	10	11	12
	Type	Buildings (sq. ft.)	Tent floors (sq. ft.)	Electric (kva.)	Water (gal. per day)	Roads (miles)	Site area (acres)	Type of buildings	Climate	Materials		Man- hours
										Short tons	Measure- ment tons	
2	2		60,000	50	25	0.75	30			178	132	8,000
3								Shell.....	Tropical.....	905	1,150	45,350
4									Temperate.....	990	1,281	47,000
5	4	54,000	51,000	100	50	1.0	30	Prefabricated.....	Tropical.....	959	1,156	41,410
6									Temperate.....	969	1,109	41,900
7								Frame.....	Tropical.....	1,526	2,140	68,720
8								TOpns.....	Temperate.....	1,418	1,970	63,800
9									Tropical.....	1,644	2,246	77,115
10								Shell.....	Temperate.....	1,827	2,488	80,000
11									Tropical.....	1,768	2,258	67,935
12	6	124,000		200	50	1.0	30	Prefabricated.....	Temperate.....	1,815	2,153	69,200
13									Tropical.....	2,766	3,658	125,390
14								Frame.....	Temperate.....	2,599	3,578	111,230
15								TOpns.....	Frigid.....	3,191	4,377	128,915

(d) 1,000-bed hospital.

	1	2	3	4	5	6	7	8	9	10	11	12
1	Type	Buildings (sq. ft.)	Tent floors (sq. ft.)	Electric (kva.)	Water (gal. per day)	Roads (miles)	Site area (acres)	Type of buildings	Climate	Materials		Man- hours (in thousands)
										Short tons	Measure- ment (tons)	
2	2	-----	125	50	50	1.0	50	{Shell.....	{Tropic.....	322	264	10.54
3										4	93	104	150	100	1.5	50	{Prefabricated.....	{Tropic.....	1,490	1,824	68.0
4	6	226	-----	250	100	1.5	50	{Frame.....	{Tropic.....										1,610	2,004	68.2
5										8	TOpns.....	{Tropic.....	1,583	1,762	59.2
6	10	Shell.....	{Tropic.....	1,600	1,753	67.3						
7				12	Prefabricated.....	{Tropic.....	2,519	3,392	101.6			
8	14	Frame.....	{Tropic.....				2,344	3,150	94.5			
9				16	TOpns.....	{Tropic.....	2,010	3,478	116.0			
10	18	Shell.....	{Tropic.....				2,909	3,918	121.2			
11				20	Prefabricated.....	{Tropic.....	2,844	3,501	99.4			
12	22	Frame.....	{Tropic.....				2,886	3,303	101.4			
13				24	TOpns.....	{Tropic.....	4,431	5,850	204.6			
14	26	Frame.....	{Tropic.....				4,223	5,820	171.3			
15				28	TOpns.....	{Tropic.....	5,191	7,110	219.0			
	30	Frame.....	{Tropic.....									
				32	TOpns.....	{Tropic.....						
	34	Frame.....	{Tropic.....									
				36	TOpns.....	{Tropic.....						
	38	Frame.....	{Tropic.....									
				40	TOpns.....	{Tropic.....						
	42	Frame.....	{Tropic.....									
				44	TOpns.....	{Tropic.....						
	46	Frame.....	{Tropic.....									
				48	TOpns.....	{Tropic.....						
	50	Frame.....	{Tropic.....									
				52	TOpns.....	{Tropic.....						
	54	Frame.....	{Tropic.....									
				56	TOpns.....	{Tropic.....						
	58	Frame.....	{Tropic.....									
				60	TOpns.....	{Tropic.....						
	62	Frame.....	{Tropic.....									
				64	TOpns.....	{Tropic.....						
	66	Frame.....	{Tropic.....									
				68	TOpns.....	{Tropic.....						
	70	Frame.....	{Tropic.....									
				72	TOpns.....	{Tropic.....						
	74	Frame.....	{Tropic.....									
				76	TOpns.....	{Tropic.....						
	78	Frame.....	{Tropic.....									
				80	TOpns.....	{Tropic.....						
	82	Frame.....	{Tropic.....									
				84	TOpns.....	{Tropic.....						
	86	Frame.....	{Tropic.....									
				88	TOpns.....	{Tropic.....						
	90	Frame.....	{Tropic.....									
				92	TOpns.....	{Tropic.....						
	94	Frame.....	{Tropic.....									
				96	TOpns.....	{Tropic.....						
	98	Frame.....	{Tropic.....									
				100	TOpns.....	{Tropic.....						
	102	Frame.....	{Tropic.....									
				104	TOpns.....	{Tropic.....						
	106	Frame.....	{Tropic.....									
				108	TOpns.....	{Tropic.....						
	110	Frame.....	{Tropic.....									
				112	TOpns.....	{Tropic.....						
	114	Frame.....	{Tropic.....									
				116	TOpns.....	{Tropic.....						
	118	Frame.....	{Tropic.....									
				120	TOpns.....	{Tropic.....						
	122	Frame.....	{Tropic.....									
				124	TOpns.....	{Tropic.....						
	126	Frame.....	{Tropic.....									
				128	TOpns.....	{Tropic.....						
	130	Frame.....	{Tropic.....									
				132	TOpns.....	{Tropic.....						
	134	Frame.....	{Tropic.....									
				136	TOpns.....	{Tropic.....						
	138	Frame.....	{Tropic.....									
				140	TOpns.....	{Tropic.....						
	142	Frame.....	{Tropic.....									
				144	TOpns.....	{Tropic.....						
	146	Frame.....	{Tropic.....									
				148	TOpns.....	{Tropic.....						
	150	Frame.....	{Tropic.....									
				152	TOpns.....	{Tropic.....						
	154	Frame.....	{Tropic.....									
				156	TOpns.....	{Tropic.....						
	158	Frame.....	{Tropic.....									
				160	TOpns.....	{Tropic.....						
	162	Frame.....	{Tropic.....									
				164	TOpns.....	{Tropic.....						
	166	Frame.....	{Tropic.....									
				168	TOpns.....	{Tropic.....						
	170	Frame.....	{Tropic.....									
				172	TOpns.....	{Tropic.....						
	174	Frame.....	{Tropic.....									
				176	TOpns.....	{Tropic.....						
	178	Frame.....	{Tropic.....									
				180	TOpns.....	{Tropic.....						
	182	Frame.....	{Tropic.....									
				184	TOpns.....	{Tropic.....						
	186	Frame.....	{Tropic.....									
				188	TOpns.....	{Tropic.....						
	190	Frame.....	{Tropic.....									
				192	TOpns.....	{Tropic.....						
	194	Frame.....	{Tropic.....									
				196	TOpns.....	{Tropic.....						
	198	Frame.....	{Tropic.....									
				200	TOpns.....	{Tropic.....						
	202	Frame.....	{Tropic.....									
				204	TOpns.....	{Tropic.....						
	206	Frame.....	{Tropic.....									
				208	TOpns.....	{Tropic.....						
	210	Frame.....	{Tropic.....									
				212	TOpns.....	{Tropic.....						
	214	Frame.....	{Tropic.....									
				216	TOpns.....	{Tropic.....						
	218	Frame.....	{Tropic.....									
				220	TOpns.....	{Tropic.....						
	222	Frame.....	{Tropic.....									
				224	TOpns.....	{Tropic.....						
	226	Frame.....	{Tropic.....									
				228	TOpns.....	{Tropic.....						
	230	Frame.....	{Tropic.....									
				232	TOpns.....	{Tropic.....						
	234	Frame.....	{Tropic.....									
				236	TOpns.....	{Tropic.....						
	238	Frame.....	{Tropic.....									
				240	TOpns.....	{Tropic.....						
	242	Frame.....	{Tropic.....									
				244	TOpns.....	{Tropic.....						
	246	Frame.....	{Tropic.....									
				248	TOpns.....	{Tropic.....						
	250	Frame.....	{Tropic.....									
				252	TOpns.....	{Tropic.....						
	254	Frame.....	{Tropic.....									
				256	TOpns.....	{Tropic.....						
	258	Frame.....	{Tropic.....									
				260	TOpns.....	{Tropic.....						
	262	Frame.....	{Tropic.....									
				264	TOpns.....	{Tropic.....						
	266	Frame.....	{Tropic.....									
				268	TOpns.....	{Tropic.....						
	270	Frame.....	{Tropic.....									
				272	TOpns.....	{Tropic.....						
	274	Frame.....	{Tropic.....									
				276	TOpns.....	{Tropic.....						
	278	Frame.....	{Tropic.....									
				280	TOpns.....	{Tropic.....						
	282	Frame.....	{Tropic.....									
				284	TOpns.....	{Tropic.....						
	286	Frame.....	{Tropic.....									
				288	TOpns.....	{Tropic.....						
	290	Frame.....	{Tropic.....									
				292	TOpns.....	{Tropic.....						
	294	Frame.....	{Tropic.....									
				296	TOpns.....	{Tropic.....						
	298	Frame.....	{Tropic.....									
				300	TOpns.....	{Tropic.....						
	302	Frame.....	{Tropic.....									
				304	TOpns.....	{Tropic.....						
	306	Frame.....	{Tropic.....									
				308	TOpns.....	{Tropic.....						
	310	Frame.....	{Tropic.....									
				312	TOpns.....	{Tropic.....						
	314	Frame.....	{Tropic.....									
				316	TOpns.....	{Tropic.....						
	318	Frame.....	{Tropic.....									
				320	TOpns.....	{Tropic.....						
	322	Frame.....	{Tropic.....									
				324	TOpns.....	{Tropic.....						
	326	Frame.....	{Tropic.....									
				328	TOpns.....	{Tropic.....						
	330	Frame.....	{Tropic.....									
				332	TOpns.....	{Tropic.....						
	334	Frame.....	{Tropic.....									
				336	TOpns.....	{Tropic.....						
	338	Frame.....	{Tropic.....									
				340	TOpns.....	{Tropic.....						
	342	Frame.....	{Tropic.....									
				344	TOpns.....	{Tropic.....						
	346	Frame.....	{Tropic.....									
				348	TOpns.....	{Tropic.....						
	350	Frame.....	{Tropic.....									
				352	TOpns.....	{Tropic.....						
	354	Frame.....	{Tropic.....									
				356	TOpns.....	{Tropic.....						
	358	Frame.....	{Tropic.....									
				360	TOpns.....	{Tropic.....						
	362	Frame.....	{Tropic.....									
				364	TOpns.....	{Tropic.....						
	366	Frame.....	{Tropic.....									
				368	TOpns.....	{Tropic.....						
	370	Frame.....	{Tropic.....									
				372	TOpns.....	{Tropic.....						
	374	Frame.....	{Tropic.....									
				376	TOpns.....	{Tropic.....						
	378	Frame.....	{Tropic.....									
				380	TOpns.....	{Tropic.....						
	382	Frame.....	{Tropic.....									
				384	TOpns.....	{Tropic.....						
	386	Frame.....	{Tropic.....									
				388	TOpns.....	{Tropic.....						
	390	Frame.....	{Tropic.....									
				392	TOpns.....	{Tropic.....						
	394	Frame.....	{Tropic.....									
				396	TOpns.....	{Tropic.....						
	398	Frame.....	{Tropic.....									
				400	TOpns.....	{Tropic.....						
	402	Frame.....	{Tropic.....									
				404	TOpns.....	{Tropic.....						
	406	Frame.....	{Tropic.....									
				408	TOpns.....	{Tropic.....						
	410	Frame.....	{Tropic.....									
				412	TOpns.....	{Tropic.....						
	414	Frame.....	{Tropic.....									
				416	TOpns.....	{Tropic.....						
	418	Frame.....	{Tropic.....									
				420	TOpns.....	{Tropic.....						
	422	Frame.....	{Tropic.....									
				424	TOpns.....	{Tropic.....						
	426	Frame.....	{Tropic.....									
				428	TOpns.....	{Tropic.....						
	430	Frame.....	{Tropic.....									
				432	TOpns.....	{Tropic.....						
	434	Frame.....	{Tropic.....									
				436	TOpns.....	{Tropic.....						
	438	Frame.....	{Tropic.....									
				440	TOpns.....	{Tropic.....						
	442	Frame.....										

RESTRICTED

e. Depots.

- (1) *Types.* Estimates are based on three types of construction for general depots and two types for ammunition storage, similar in permanence to troop housing of the same type numbers, as follows:

(a) *General depots.*

1. *Type 2.* Class IV tents for all facilities requiring cover. Open storage cleared and graded. Roads graded but not improved.
2. *Type 3.* Sheds for covered storage; Class IV tents with floors for administrative areas; without floors for other facilities requiring cover. Roads stabilized. Railroad sidings to open storage areas.
3. *Type 5.* Closed buildings for covered storage and administrative facilities. Bituminous surfaced main access roads to covered and open storage areas; other interior roads stabilized. Railroad sidings to storage areas.

(b) *Ammunition storage.*

1. *Type 2.* Class IV tent for 10 percent of the ammunition tonnage and for administrative facilities. Open storage areas cleared and graded. Access roads graded but not improved.
2. *Type 3.* Sheds for 10 percent of the ammunition tonnage. Buildings for administrative facilities. Access roads and parts of open storage areas stabilized with local materials. Railroad sidings to storage areas.

- (2) *Material and man-hour requirements for depot construction of the above types.*

(a) *Covered storage in general depots.*

	1	2	3	4	5	6	7	8	9	10	11	12
	Type	Nominal size of depot (M sq. ft.)	Structures			Electricity (kva.)	Roads (miles)	Railroads (miles)	Site area (acres)	Materials		Man-hours (thousands)
			Tents (M sq. ft.)	Open side (M sq. ft.)	Closed side (M sq. ft.)					Short tons	Measure (tons)	
2	2	100	103.5				0.5		9	2	2	2.0
3	3		3.5	100	1.1	30	.5		9	208	223	11.0
4	5				127.4	37	.5	0.5	9	1,016	930	34.9
5	2	250	258				2.0		20	9	9	7.0
6	3		8	249.8	5.4	.85	2.0		20	643	643	33.1
7	5				262.8	.85	2.0	1.3	20	2,348	2,220	97.4
8	2	500	515				4.0		40	18	18	13.9
9	3		15	499.5	5.4	150	4.0		40	1,100	1,165	70.8
10	5				527.5	150	4.0	2.5	40	3,623	3,770	182.2

(b) Open storage in general depots.

	1	2	3	4	5	6	7	8
1	Type	Nominal size of depot (M sq. ft.) (open storage)	Roads (miles)	Railroads (miles)	Site area (acres)	Materials		Man-hours (thousands)
						Short tons	Measurement (tons)	
2	2	100	0.3	-----	5	1	1	1.86
3	3		.3	0.6	5	232	183	8.00
4	5		.3	.6	5	239	196	9.48
5	2	500	1.5	-----	25	8	8	6.42
6	3		1.5	3.0	25	1,123	867	35.67
7	5		1.5	3.0	25	1,177	945	43.67
8	2	1,000	3.0	-----	51	14	14	12.68
9	3		3.0	6.0	51	2,220	1,734	71.2
10	5		3.0	6.0	51	2,353	1,886	84.60

(c) Ammunition storage.

1	2	3	4	5	6	7	8	9	10	11
	Type	Depot capacity (tons/day)	Structures		Open storage acres	Roads (miles)	Railroad (miles)	Site area (acres)	Materials	
			Tents (sq. ft.)	Buildings (sq. ft.)					Short tons	Measurement tons
2	2	600	-----	-----	0.2	.0.15	-----	80	1	1
3	2	18,000	4,500	-----	8.25	4.5	-----	2,340	25	24
4	3		-----	6,600	8.25	4.5	0.6	2,340	302	253
5	2		19,500	-----	27.5	15	-----	7,800	84	80
6	3	60,000	-----	20,520	27.5	15	2.0	7,800	1,004	842
7	2	240,000	78,000	-----	110	60	-----	31,200	335	319
8	3		-----	77,760	110	60	8.0	31,200	3,993	3,334

f. Shops.

(1) Covered shop requirements in square feet of floor area for various service units.

1	2	3
	Service	Unit
2	Chemical.....	Square feet
	Depot Company (Comm. 2).....	1,000
	Decontamination company.....	800
	Laboratory.....	5,200
	Processing company, M2 plant.....	7,500
	Maintenance company.....	4,600
3	Engineer.....	Gas Generator team.....
		2,000
		Foundry team.....
		2,500
		Field maintenance company.....
		9,000
4	Ordnance.....	Medium automotive maintenance company.....
		25,000
		Heavy automotive maintenance company.....
		40,000
		Base armament maintenance battalion.....
		100,000
		Base automotive maintenance battalion.....
		100,000
		Heavy maintenance company, field army.....
		30,000
		Medium maintenance company.....
		20,000
		Tire repair company.....
		16,000
		Motor vehicle distributing company.....
		12,000
		Motor vehicle assembly company.....
		20,000
5	Signal.....	Base maintenance company.....
		50,000

RESTRICTED—Security Information

(2) *Material and man-hour requirements for various standard buildings suitable for shops.*

	1	2	3	4	5	6	7	8	9	10
1	Type of building	T Opns No.*	Floor area (square feet)	Electric (kva.)	Water (M gallons per day)	Roads (miles)	Hard standings (square yards)	Materials		Man-hours (thousands)
								Short tons	Measurement (tons)	
2	Rigid frame.....	11.44.....	3,000	15	0.2	.05	100	53	59	2.4
3	Rigid frame.....	11.21.....	5,400	15	.5	.5	200	69	68	3.0
4	Rigid frame.....	11.26A.....	16,000	50	1.8	.16	625	238	212	9.1
5	Shell.....	211.71.....	2,400	10	.2	.5	100	55	46	1.6
6	Navy rigid frame..	Utility.....	4,000	10	.2	.5	100	62	53	4.8

* Plans and specifications published in TM 5-280.

g. Ice Plants and Refrigerated Storage.

- (1) Each man will require a minimum of 2.50 cubic feet or a maximum of 5 cubic feet of refrigerated storage per month of supply.
- (2) Ice requirements are 2 pounds per day in the Temperate and Tropical zones. None is required in the Arctic zone.

	1	2	3	4	5	6	7	8
1	Facility	T Opns building No.*	Capacity		Building area (square feet)	Construction materials		Man-hours
			Tons/day	Cubic feet		Short tons	Measurement tons	
2	Ice plant.....	27.11	1.0	-----	550	22	39	1,250
3	Ice plant.....	27.6	3.6	-----	1,040	50	90	2,250
4	Ice plant.....	27.7	15.0	-----	2,080	132	226	2,650
5	Refrigerated warehouse.....	27.5	-----	12,700	2,000	71	118	1,650
6	Refrigerated warehouse.....	27.13	-----	150,000	16,000	800	1,500	20,200

* Plans and specifications published in TM 5-280.

h. Personnel Service Facilities. Material and man-hour requirements for buildings.

	1	2	3	4	5	6	7	8
	Building	Description	Climate	TOPns No. ¹	Area (square feet)	Materials		Man-hours
						Short tons	Measurement (tons)	
2	10,000 man..	Laundry and boilerhouse ²	Temperate and tropic.	25. 20	9, 350	225	259	7, 400
3	10,000 man..	Laundry and boilerhouse.	Frigid.....	125. 21	9, 350	144	168	6, 100
4	5,000 man..	Laundry and boilerhouse.	Temperate and tropic.	25. 15	6, 400	138	158	4, 200
5	5,000 man..	Laundry and boilerhouse..	Frigid.....	125. 16	6, 400	103	115	3, 300
6	5,000 man..	Dry cleaning plant and boilerhouse.	Temperate and tropic.	25. 37	2, 960	48	48	1, 400
7	5,000 man..	Dry cleaning plant and boilerhouse.	Frigid.....	25. 37	2, 960	64	111	1, 400
8	2,500 man..	Dry cleaning plant and boilerhouse.	Temperate and tropic.	25. 36	1, 900	27	31	980
9	2,500 man..	Dry cleaning plant and boilerhouse.	Frigid.....	25. 36	1, 900	27	33	1, 000
10	Mobile.....	Bakery building ³	Temperate and tropic.	211. 71	10, 000	96	79	1, 970
11	Mobile.....	Bakery building ⁴	Frigid.....	116. 8	10, 000	199	251	6, 600
12	Floor space for special service or base P. O. facilities. ⁵ ⁶		Temperate and tropic.	211. 71	100, 000	800	818	18, 400
13	Floor space for special service or base P. O. facilities.		Frigid.....	111. 2	100, 000	1, 768	2, 580	65, 200

¹ Troop laundries and dry-cleaning plants are rigid frame TOPns construction and for planning purposes two sizes of each facility are shown in the tables.

² Laundries and dry-cleaning plants are to furnish all the normal cleaning needs of 100,000 men. Sufficient facilities are provided so that these needs normally can be accomplished in a 16-hour day, 6 days per week. Tbls allows an extra shift per day plus an extra day per week for abnormal conditions.

³ A processing company is equipped with two plants (M1 or M2); when operated from a semi-fixed installation each plant is capable of processing 3,000–4,000 pounds (500–650 uniforms) per day. Two efficient plants (one company) can process 10,000 pounds in 24 hours. Chemical processing units usually operate in conjunction with quartermaster laundry units. The M1 plant is a substitute for the M2 plant. Operating capacities of the M1 and M2 plants are approximately equal.

⁴ Shell buildings.

⁵ The QM mobile bakery requires building space to house its equipment when operating for an extended period of time in one location.

⁶ Bakeries will be required to produce 46,000 pounds daily and facilities are provided to accomplish this in 18 operating hours each day, every day. The extra 6 hours per day are intended to be used for unforeseen or special requirements.

⁷ Recreation facilities for special service activities in the communications zone require building space estimated at 11 square feet per man in the communications zone.

⁸ Base post offices require building space estimated at 0.35 square feet per man in the theater.

i. POW Camps.

(1) *Types.* Estimates are based on two types, types 2 and 3, of permanence similar to troop housing of these types and described as follows:

(a) *Type 2.* Class IV tents for POW housing. Engineer construction consists in the security fences, lighting and guard towers, and in water piping to the central enclosure. Waste disposal is by pit latrine.

- (b) *Type 3.* Facilities comparable with those for type 3 troop housing, with modifications as required for security, and specifically including fences, lighting and guard towers.

(2) *Material and man-hour requirements.*

Type	Size (num- ber of POWs)	Structures		Elec- tric (kva.)	Water (M gallons per day)	Fence (M linear feet)	Roads (miles)	Site area (acres) (10 M square yards)	Materials		Man- hours (thou- sands)
		Build- ings (M square feet)	Tents (M square feet)						Short tons	Meas- urement (tons)	
2	500	-----	25	10	WP	4	0.2	4.84	39	53	3.5
	20,000	-----	1,000	300	60	44	2.0	108.90	414	511	37.6
3	500	2.7	20	10	5	4	.2	4.84	83	125	6.3
	20,000	71.3	644.4	400	200	44	2.0	108.90	1,861	3,868	104.3

j. *Bivouacs, Camps and Billets.*

- (1) *Bivouac areas.* The bivouac area of a regimental combat team will vary from 50 acres to 1 square mile, as indicated by the situation and in proportion to the dispersion necessary and to the amount of concealment and cover available. The approximate minimum area required by a unit may be estimated as indicated in (2) below where personnel is the consideration, or on the following basis where the number of vehicles with the unit should govern (the larger areas determined by the two methods will be used): Take the square root of the number of vehicles with the unit, multiply by the desired dispersion in yards; this will give the dimensions in yards of a square area required to accommodate the unit.

Example: Assume that a regimental combat team has 350 vehicles, and a dispersion of 100 yards between vehicles is desired. Square root of 350 is approximately 19. 19 times 100 equals 1,900 yards, which is the length of a side of the square required, or approximately $\frac{1,900}{70} \times \frac{1,900}{70} = 737$ acres. Personnel will be distributed throughout the area. (This will vary with the type of warfare and the type of terrain.)

Note.—The number of acres in a rectangular tract is approximately equal to the product of $\frac{1}{2}$ of the length in yards by $\frac{1}{2}$ of the breadth in yards. One acre equals 4,840 square yards (about 70 yards square). 1 square mile equals 640 acres.

- (2) *Tent camps—capacity.* Large pyramidal tent, normal assignment—6–8 men per tent; area required for regimental combat team camp (open ground) approximately—50 acres; estimate of area required—50 square yards per man; 100 square yards per vehicle.

(3) *Data on tentage.*

1	1		2	3	4	5	6
	Data on Tentage		Surface area (square feet)	Floor space (square feet)	Vertical wall (height)	Weight in pounds per unit (packed)	Cubage per unit (packed)
	Type	Dimensions					
2	Assembly.....	40 ft. x 80 ft.....	4,965	2,860	8 ft. 0 in.....	1,000	34.35
3	Command post..	11 ft. 10 in. x 7 ft. 6 in.....	328	90	6 ft. 2 in.....	114	6.8
4	Hospital ward..	50 ft. x 16 ft.....	2,162	800	4 ft. 6 in.....	395	19.8
5	Pyramidal.....	16 ft. x 16 ft.....	896	256	3 ft. 0 in.....	133	6.0
6	Storage.....	17 ft. 10 in. x 20 ft. 5 in.....	1,008	364	5 ft. 2 in.....	210	6.5
7	Wall, large.....	14 ft. 6 in. x 14 ft. 4 in.....	570	210	4 ft. 6 in.....	152	6.1
8	Wall, small.....	18 ft. 10 in. x 9 ft. 2 in.....	492	168	3 ft. 9 in.....	57	2.7
9	Paulin, large.....	20 ft. x 40 ft.....	800			160	4.2
10	Paulin, small.....	12 ft. x 17 ft.....	204			57	2.3
11	Screen, latrine..	8 ft. x 52 ft.....	416			45	1.1
12	Squad.....	16 ft. x 32 ft. 7.5 in.....	886	522	4 ft. 9 in.....	474	18.5

(4) *Space allowances for quarters under Theater of Operations conditions:*

(a) *Normal.* 40 square feet floor space and 400 cubic feet air space per person.

(b) *Emergency.* 50 percent of the above.

(5) *Billets.* In hostile or liberated territory the capacity of a locality for billeting is approximately as follows:

Rich farming country.....	5 per inhabitant.
Cities.....	2 per inhabitant.
Average American city.....	20 per vacant dwelling.
Vacant buildings and dwellings in average city (civilians may be caused to move to vacancies in order to concentrate military activities).	10 percent of population.
With civilians furnishing subsistence.....	10 percent of population for 1 week.

k. Housing Requirements in Addition to Troop Camps. In addition to those troop housing facilities provided for normal functions of troops, it is usually necessary to provide additional installations based upon the following percentages of the theater population.

1	1	2
	Facility	Percentage of theater troops
2	Recreation center.....	5% of total.
3	Rehabilitation center.....	2% of total.
4	Reception center.....	5% of total.
5	Replacement depot.....	3% of total.
6	Casual camp.....	1% of total.
7	Ground troop training center.....	5% of all ground forces.
8	Service force training center.....	5% of all service troops.
9	Labor camp.....	5% of prewar population in area.
10	Temporary refuge for displaced persons.....	5% of prewar population in area.
11	Military prisoners.....	1% of total.
12	Undesirable civilians (saboteurs, etc.).....	5% of prewar population in area.

l. Office Space. Space allowances for offices under Theater of Operations conditions: 60 square feet per person employed, plus 10 square feet per drafting board.

m. Shell, Prefabricated, and Standard Frame Buildings.

- (1) The shell building TOPns 211.71 (with dimensions of 20' x 54') consists of pre-cut wooden framing, with the roof and part of the sides covered with corrugated steel sheets. All the material for the 20' x 54' building is shipped in a single package. The length may be changed by the addition or omission of 9' intermediate bays. The width may be increased to 46' by modifying the heights of the posts, and the roof system. Partial insulation can be obtained by closing the sides and using a special kit; and complete insulation with additional sidewall materials. A two-inch concrete floor is laid if required. This type is suitable for temperate and tropical climates.
- (2) The shell building TOPns 211.75 (with dimensions of 110' by 405') consists of pre-cut wooden framing with a corrugated steel roof and open sides. It is shipped in 31 packages. If required, the sides are closed and a concrete floor laid. This building is used primarily for depot storage.
- (3) Barrack, portable, prefabricated steel angle frame, TOPns 211.59 and TOPns 111.61, (with dimensions of 20' x 48') is the basic unit for prefabricated construction. This building can be modified and expanded by the addition of 20' x 8' units. These units are designated as window unit "B", and door unit "C", respectively. These buildings are normally used only in hospital construction; TOPns 111.61 in temperate climates, and TOPns 211.59 in tropic climates.
- (4) Standard frame buildings are constructed in various dimensions and designs from standard materials listed in TM 5-280. Because of the large lumber and man-hours requirements involved, this construction is normally restricted to special purpose buildings such as refrigerated warehouses, ice plants, laundries, dry cleaning plants, special shops, and facilities for frigid climates.

260. Bulk Petroleum Storage and Distribution

a. General. See paragraphs 92 through 102 for petroleum requirements; paragraph 93 for types and capacity of carriers in general use; and paragraph 184 for types and capacity of pipelines. See TM 5-350 for descriptions and operating characteristics of pipeline equipment and AR 890-15 for responsibilities. A pipeline system includes all necessary pipe, fittings, pump stations, tanks and dispensing facilities, complete and in operating condition.

b. Tanks. Capacity, dimensions, weight, and cubage of standard bolted steel tank sets are given in the table below. All the valves, pipe fittings, and pipe necessary to connect the tank to the tank farm trunk line or pump station is included in the weight and cubage. The tank sheets and other material is crated or bundled ready for shipment by land, sea, or air. The 10,000 and 42,000 gallon tank sets are provided with 6'' valves, fittings, and 1,700 feet of victaulic coupled 6'' pipe and couplings. The 420,000 gallon tank sets contain 8'' valves, fittings and 1,600 feet of 8'' victaulic coupled pipe and couplings. See paragraph 93 for the "pillow" type portable fabric tank.

	1	2	3	4	5	6
1	Set No.	Capacity (gallons)	Diameter	Height	Weight crated (pounds)	Cubic feet crated
2	890-01.....	10,000	15'-4½''	8'-1½''	23,931	840
3	890-02.....	42,000	21'-6¾''	16'-1''	32,734	989
4	890-04.....	420,000	54'-11½''	24'-1½''	106,127	3,178

c. Pipelines. The 6 inch, 13.92 pounds per foot, grooved ends for couplings, pipe is standard for military pipeline systems, however, 4 inch, 9.32 pounds per foot grooved end pipe is used for special purposes, such as a small isolated air strip or fuel dump. Eight inch and larger pipe is used to rehabilitate civil systems and tank farm headers. Submarine ship-to-shore lines are 8 inch in order to unload a tanker as quickly as possible.

	1	2	3	4
1	Pipe (diameter inches)	Gallons per 20-hour day	Net short tons per day motor gaso-line	Short tons per day after packaging in 5-gallon drums
2	6.....	660,000	2,246	2,682
3	4.....	288,000	883	1,055

d. Construction Rates. Pipeline and bulk storage facilities are constructed only by specially trained troops such as the engineer pipeline company, except that about 50 percent of a force employed on such construction can be given work which does not require special training. For planning purposes, the construction to be assigned to one engineer pipeline company or platoon, including the hauling of the materials an average distance of 50 miles, is as follows:

	1	2	3
1	Item	Unit	Construction rate
2	6" pipeline system, complete pump station construction	Company.....	4 mi./day.
	Tank erection:	Platoon ¹	1 in 7 days.
3	42,000 gallons.....	Platoon.....	1 in 2 days.
4	420,000 gallons.....	Platoon.....	1 in 7 days.

¹ 4 per company.

e. Pipeline Operation. The standard 6-inch pipeline, when pumped at a rate of 550 gallons per minute (660,000 gals. per 20-hr. day) requires pump stations at 16-mile intervals on level ground. The engineer petroleum distribution company is organized to operate 10 such pump stations and appurtenant facilities. A battalion of four such companies normally operates 600 miles or more of pipeline; or, within its capacities it carries out construction and operation simultaneously. (TM 5-350.)

f. Pipeline Communications. A pipeline system requires a continuous and exclusive system of wire communication, with a minimum of two circuits from the headquarters or terminal to each pump station, tank farm and dispensing point. Telephones are used on short lines; teletype for lines 100 miles or more in length. However, on long lines teletype equipment is required in only about every fifth pump station.

g. Tank Farms. Construction factors for tank farms of various size, designed for one or three petroleum products using the 10,500—42,000 and 420,000, gallon standard bolted, steel tank sets are as follows:

RESTRICTED

	1	2	3	4	5	6	7	8	9	10
1	Size of tanks (gals.)	No. of tanks	Materials			Labor man-hours			Site area 10 M sq yds	
			Weight of each tank includes; tank plates, valves, fittings and 1,600 feet of pipe			Erection includes the tank, manifold, assembled and pipe laid to trunk line, fire walls and roads in tank farm				
			Weight per tank (short ton)	Total short tons	Measured tons per tank	Total measured tons	Erection and manifold	Clear grade		Total man-hours
210,000 gallons or 5,000 barrels tank farm designed to handle 5 products*										
2	42,000.....	6	20	120	32	192	9,000	1,950	10,950	5.81
210,000 gallons or 5,000 barrels tank farm designed to handle 1 product only										
3	42,000.....	5	20	100	32	160	7,500	1,625	9,125	4.84
630,000 gallons or 15,000 barrels tank farm designed to handle 3 products*										
4	42,000.....	6	20	120	32	192	9,000	1,950	10,950	5.81
5	420,000.....	1	53	53	79	79	4,500	375	4,875	.97
6	Total.....	7		173		271	13,500	2,325	15,825	6.78

See footnote at end of table.

RESTRICTED—Security Information

1	2	3	4	5	6	7	8	9	10
1	Size of tanks (gals.)	No. of tanks	Materials			Labor man-hours			Site area 10 M sq yds
			Weight of each tank includes; tank plates, valves, fittings and 1,600 feet of pipe			Erection includes the tank, manifold, assembled and pipe laid to trunk line, fire walls and roads in tank farm			
			Weight per tank (short ton)	Total short tons	Measured tons per tank	Total measured tons	Erection and manifold	Clear grade		Total man-hours

680,000 gallons or 16,000 barrels tank farm designed to handle 1 product only

7	42,000.....	5	20	100	32	160	7,500	1,625	9,125	4.84
8	420,000.....	1	53	53	79	79	4,500	375	4,875	.97
9	Total.....	6		153		239	12,000	2,000	14,000	5.81

2,810,000 gallons or 66,000 barrels tank farm designed to handle 3 products*

10	42,000.....	3	20	60	32	96	4,500	975	5,475	4.84
11	420,000.....	6	53	318	79	474	27,000	2,250	29,250	1.94
12	Total.....	9		378		570	31,500	3,225	34,725	6.78

2,810,000 gallons or 66,000 barrels tank farm designed to handle 1 product only

13	42,000.....	5	20	100	32	160	7,500	1,625	9,125	4.84
14	420,000.....	5	53	265	79	395	22,500	1,875	24,375	4.84
15	Total.....	10		365		555	30,000	3,500	33,500	9.68

4,200,000 gallons or 100,000 barrels tank farm designed to handle 3 products*

16	42,000.....	5	20	100	32	160	7,500	1,625	9,125	4.84
17	420,000.....	10	53	530	79	790	45,000	3,750	48,750	9.68
18	Total.....	15	-----	630	-----	950	52,500	5,375	57,875	14.52

4,200,000 gallons or 100,000 barrels tank farm designed to handle 1 product only .

19	420,000.....	10	53	530	79	790	45,000	3,750	48,750	9.68
----	--------------	----	----	-----	----	-----	--------	-------	--------	------

6,510,000 gallons or 155,000 barrels tank farm designed to handle 3 products*

20	42,000.....	8	20	160	32	256	12,000	2,600	14,600	7.74
21	420,000.....	16	53	848	79	1,284	72,000	5,000	77,000	15.48
22	Total.....	24	-----	1,008	-----	1,520	84,000	7,600	91,600	23.22

6,510,000 gallons or 155,000 barrels tank farm designed to handle 1 product only

23	42,000.....	5	20	100	32	160	7,500	1,625	9,125	4.84
24	420,000.....	15	53	795	79	1,185	67,500	5,625	73,125	14.52
25	Total.....	20	-----	895	-----	1,345	75,000	7,250	82,250	19.36

*Products stored by type of product—60 percent Mogas, 35 percent Avgas, 5 percent diesel.

RESTRICTED

261. Airfield Construction

a. Construction Effort Required for Airfields in a Theater of Operations. This section is useful for broad planning purposes only. For overseas theaters it provides estimates for computing Engineer support required to construct United States Air Force installations. None of the factors in this section are suitable for the detailed planning required for construction of specific installations. Reference should be made to AFM 400-5 for more detailed planning data.

- (1) The table below gives the number of aviation engineer battalion months required to accomplish the full and minimum operational construction of different types bases. The time requirements are shown separately for new and reconstructed bases. These are average factors applicable to average combat, climatic, transportation, etc., conditions.

1	Type base *	2	3	4	5
		New base		Reconstructed base ^b	
		Full operational	Minimum operational	Full operational	Minimum operational
	Strategic:				
2	Heavy bomber (2 wings) -----	32	18	25	13
3	Heavy bomber (1 wing) -----	18	11	13	7
4	Medium bomber (2 wings) -----	16	10	12	6
5	Medium bomber (1 wing) -----	10	6	7	4
	Tactical:				
6	Light bomber or composite (2 wings) -----	6	3.5	4	2.5
7	Light bomber (1 wing) -----	4	2.5	3	1.5
8	Fighter (Jet-1 wing) -----	4	2.5	3	2
9	Fighter (Jet-1 sq) -----	2.5	1.8	2	1.3
10	Fighter (Jet-1 sq w/wg hq, or 2 sqs) -----	3	2	2.5	1.5
11	Fighter (Recip*-1 wg) -----	3	2	2.5	1.5
12	Fighter (Recip*-1 sq) -----	2	1.5	1.5	.8
13	Fighter (Recip*-1 sq w/wg hq, or 2 sqs) -----	2.5	1.5	2	1
	Tactical Support advanced airfields:				
14	Fighter-bomber (Jet-1 wg) -----	2.5	1.	1.3	.8
15	Fighter-bomber (Jet-1 sq) -----	1.	.7	.8	.5
16	Fighter-bomber (Recip*-1 wg) -----	1.5	.8	1.	.5
17	Fighter-bomber -----	.8	.4	.5	.3
18	Troop carrier -----	.4	.2	.3	.1
19	Cargo -----	.5	.3	.35	.2
	Troop carrier:				
20	(2 wgs) -----	5	3	3.5	2
21	(1 wg) -----	3.5	2.5	3	1.5
	MATS:				
22	(Route base, small) -----	3	1.5	2	1
23	(Route base, large) -----	4	2	3	1.5
24	(Terminal, small) -----	5	3	4	2
25	(Terminal, large) -----	7	4	5	3
	Air depot:				
26	(Using existing runway) -----	6	4	5	3
27	(Runway included) -----	8	5	6	4

See footnotes on next page.

NOTES

• Reciprocating type engines.

• General base requirements:

- (1) HB (B-36B and D without jet pods at 326,000 pounds gross take-off weight and B-36D with jet pods at 357,000 pounds gross take-off weight). Average runway 250' x 9,000' with 144,000 pounds single gear load. Bulk avgas storage of 25,000 barrels per group.
- (2) MB—conventional (B-29/50 at 173,000 pounds gtw). Average runway 170' x 9,300' with 76,500 pounds single gear load. Bulk avgas storage of 25,000 barrels per group.
- (3) MB—Jet (B-47 at 185,000 pounds gtw). Average runway 170' x 8,300' (take-offs with 20,000 pounds JATO) with 85,000 pounds single gear load. Bulk fuel storage of 60,000 barrels per group or 20,000 barrels per separate squadron.
- (4) LB—conventional (B-26 at 38,000 pounds gtw). Average runway 130' x 7,900' with 17,100 pounds single gear load. Runway for a *composite* air base (combined base for one wing ea of LB and F, TC, MATS, or Depot, etc) to be constructed to highest specifications required by any type aircraft to be operated from it. Bulk avgas storage of 15,000 bbls. per LB group.
- (5) LB—Jet (B-45C at 113,000 pounds gtw). Average runway 170' x 9,600' (take-off with 8,000 pounds JATO) with 50,000 pounds single gear load. Bulk fuel storage of 60,000 bbls. per group or 20,000 barrels per separate squadron.
- (6) Fighter (reciprocating engine) (F-47N standard). Average runway 130' x 8,500' with 9,000 pounds single gear load. Bulk avgas storage of 15,000 barrels per group or 5,000 barrels per separate squadron.
- (7) Fighter (Jet) (F-84E standard at 18,170 pounds gtw (basic mission) or 22,000 pounds gtw (escort mission) w/2,000 lbs. JATO). Average runway 130' x 9,000' with 9,000 pounds single gear load. Bulk fuel storage of 15,000 barrels per group or 5,000 barrels per separate squadron.
- (8) Tactical support Fighter-Bomber (Jet) (F-84E standard at approximately 19,000 pounds gtw). Average runway 110' x 9,000' (emergency standard—25 percent safety factor) with 8,000 pounds single gear load bearing capacity and with temporary type surfacing. Avgas on-base operating storage of 6,000 barrels per group or 2,000 barrels per separate squadron (3 complete refuelings) is desirable but initial operations will be supplied directly from trailer refueling units and from emergency drum or portable storage tank stocks.
- (9) Tactical Support Fighter-Bomber (reciprocating engine). (F-47N standard at 20,867 pounds gtw). Average runway 110' x 6,500' (emergency standard—25 percent safety factor) with 8,000 pounds single gear load bearing capacity and with temporary type surfacing. Avgas on-base operating storage of 6,000 barrels per group or 2,000 barrels per separate squadron (3 complete refuelings) is desirable but initial operations will be supplied directly from refueling units and from emergency drum or portable tank stocks.
- (10) Tactical Support Troop Carrier and Cargo (C-54, C-82, C-119 at 74,000 pounds gtw). Average runway 140' x 5,500' with 35,000 pounds single gear load bearing capacity with temporary type surfacing. No on-base avgas bulk storage required for initial operations. Ultimate storage requirement will be based on subsequent utilization of base.
- (11) Troop Carrier (C-119 at 74,000 pounds gtw, C-82, C-122, C-125). Average runway 170' x 5,700' with 35,000 pounds single gear load. Bulk avgas storage of 10,000 barrels per group.
- (12) MATS Route Base, Small (C-54 longest runway; C-119 largest type A/C at 74,000 pounds gtw). Average runway 170' x 5,700' with 35,000 pounds single gear load. Bulk avgas storage of 5,000 barrels.
- (13) MATS Route Base, Large (C-124 largest type A/C at 210,000 pounds gtw, C-74, C-97). Average runway 350' x 11,000' with 160,000 pounds single gear load. Bulk avgas storage of 20,000 barrels.
- (14) MATS Terminal Small (C-97 largest type aircraft at 150,000 pounds gtw). Average runway 250' x 8,700' with 85,000 pounds single gear load. Bulk avgas storage of 20,000 barrels.
- (15) MATS Terminal, Large (C-124 largest type A/C at 210,000 pounds gtw). Average runway 250' x 110,000 pounds single gear loads. Bulk avgas storage of 25,000 barrels.
- (16) Air Depot. Average runway 170' x 7,000' with 60,000 pounds single gear load. Bulk avgas storage of 10,000 barrels.

^b A reconstructed base makes use of a site where an airfield of some type does exist or has existed. A general factor of 75 percent of total construction of a new base is used to estimate the average construction required to reconstruct an existing base.

- (2) The characteristics given in the footnotes of above table represent requirements for average T/O air bases as they will probably be constructed by aviation engineer troops. Runway lengths are based essentially on a minimum operational standard and are adjusted to requirements under expected average conditions of elevation and temperature, which for purposes of these criteria have been assumed to be approxi-

mately 1,000 feet and 80° F. All other facilities are based generally on full operational standard. Facilities on tactical support advanced airfields are limited by the urgent and temporary requirement for such installations, to an approximation of emergency operational requirements for standard tactical bases. Subsequent improvement of these tactical support airfields into standard air bases will require additional construction commensurate with that required to reconstruct an existing base. Pavement bearing capacity requirements are expressed in single main gear loads (45 percent of gross loadings) of the heaviest standard types aircraft operating from the respective type bases. Bulk avgas storage requirements are given as the average operating storage to be constructed on-base by aviation engineer units and represents generally a 15-day level.

- (3) The number of aviation engineer battalion months required to construct the different type bases is calculated from the man-hour workload needed to build each base. This is determined by specifying for each type base the kinds and numbers of facilities required for the performance of the function of the units supported by the base; i. e., AACs station, housing, runway, etc. Each of these facilities is then broken down into the kinds and number of elements composing it; i. e., paved surfaces, shops, mess halls, latrines. A man-hour factor, such as 1.45 man-hours per square yard of paved surface, is then applied to each of these elements to compute the total man-hours required to construct each element. The number of man-hours for all elements are then added together to give the total man-hours required to construct the base. This man-hour total is then converted to aviation engineer battalion months by the factor; 110,000 man-hours of construction is equivalent to 1 engineer aviation battalion month.

b. Typical Engineer Force Required for the Construction of United States Air Force Installations in a Theater of Operations. In order to compute manning, training, and equipping requirements, it is necessary to convert engineer battalion months as given above to engineer aviation battalions. Thus, a construction task requiring 8 engineer battalion months can be accomplished by 1 engineer battalion working for 8 months, 2 engineer battalions for 4 months, or 4 engineer battalions for 2 months, etc. Obviously, under extreme emergency conditions, one would like to construct as complex an installation as a heavy bomber base in a matter of days. Theoretically this could be done by concentrating enough battalions in the area to perform the required

number of months of construction. However, the effect of oversaturation comes into play, and the efficiency of the work diminishes as the personnel, equipment, and supplies of the different battalions create interference. On the basis of these saturation considerations, the following table presents estimates of the "desirable" number of engineer aviation battalions to be employed for the different types of construction.

- (1) The table below presents the composition of a typical engineer force required for the construction of USAF facilities in a theater of operations, including group, brigade, and command organizations. This, therefore, permits the computation of overhead personnel, in addition to direct personnel, required for aviation engineer construction work.¹

	1	2	3	4
1	Type units	T/O & E No.	Number of units in typical theater	Remarks
2	Engr Avn Comd Hq & Hq Co ¹ ..	200-1	1	1 per theater AF having more than 1 Engr Avn Brigade.
3	Engr Avn Brig Hq & Hq Co ¹ ..	5-72	3	1 per 2-4 Engr Avn Gps. Augmented with administrative personnel when not under an Engr Avn Comd.
4	Engr Grnp Hq & Hq Co.....	5-412	9	1 per 2-4 Engr Avn Bns depending on deployment.
5	Engr Avn Bn.....	5-415	18	{ ½ of battalions assigned are augmented.
6	Engr Avn Bn (Augmented).....	5-415	9	
7	Engr Avn Depot Co.....	5-47	6	1 per Engr Avn Brigade.
8	Engr Avn Maint Co.....	5-157	9	1 per Engr Avn Gp.
9	Engr Avn Topo Co ²	5-400	1	1 per Engr Avn Comd.
10	Engr Avn Topo Det ³	5-400	3	1 per Engr Avn Brig.
11	Engr AF Hq Co ⁴	5-800-2	1	1 per Engr Avn Comd.
				Engineer Aviation Battalions Required to construct: ⁵
12	B-36 Base.....			4 Bns for 8 months.
13	B-29 Base.....			3 Bns for 5½ months or 2 Bns for 8 months.
14	Other Air Base.....			2-3 Bns for 3-4 months.
15	Air Depot.....			1 Bn for 6-8 months or 2 Bns for 3-4 months.

¹ Columns 8, 9, 10, 13, 19 of T/O & E.

² Column 15 of T/O & E to be incorporated in the new T/O & E of the Engr Avn Brigade.

³ Army troops are required to construct facilities off the base, such as roads, ports, pipelines, general hospitals, general depots, etc.

⁴ To be incorporated in the new T/O & E of the Engr Avn Comd.

⁵ Assumed minimum of 2 Air Force wings per air base.

¹ Based on new T/O & E to be published.

- (2) The desirable number of battalions to perform the different construction jobs, as enumerated in the first table are based on judgement and experience. In point of fact, under actual operations, it is not unlikely that the number of battalions used will deviate from these desirable standards. This is because the availability of aviation engineer battalions and the requirements for them may not permit attainment of these standards.

Section III. ORDNANCE

262. Vehicle Losses

Estimated daily losses in front line divisions of general purpose vehicles destroyed and evacuated, number per 1,000 of actual vehicle strength:

	1	2	3	4
	General type of operations for the force as a whole	Destroyed	Require repair by unit maintenance section ¹	Require field or base maintenance
1				
2	Infantry division in attack of fortified position	27	27	15
3	Infantry division in attack of deliberately organized position	16	15	11
4	Infantry division in attack of hastily organized position	10	10	9
5	Infantry division in covering, security force, retirement, or delaying action	5	5	7
6	Infantry division in defense of position	9	7	7
7	Infantry division in inactive situation ²	3	2	6
8	Infantry division in pursuit	5	5	7
9	Infantry division in assault of hostile shore	27	30	20
10	Infantry division in reserve	Negligible	³ 2	³ 1
11	Armored division in attack	16	15	11
12	Armored division in inactive situation ²	3	2	6
13	Armored division in pursuit or exploitation	5	8	10
14	Armored division in retirement or delaying action	5	5	7
15	Armored division in reserve	Negligible	³ 2	³ 1

¹ These quantities are in addition to the number in unit maintenance section each day for scheduled servicing.

² Forces in contact, neither side attacking.

³ These figures do not apply during rehabilitation.

Section IV. SIGNAL

263. Construction Factors

a. Estimated time required for line work operations.¹

	Man-hours placing	Removing
Laying out and staking line open wire:		
150-foot span—mile	15	
Material Distribution:		
Lightweight metal poles—each	0.4	
Round wooden poles—each	.5	
Wire and accessory materials 150-foot span—4 pairs—mile	6.0	
Insulated wire and accessory materials—150-foot span—mile	2.0	
Lead cable and accessory materials—per reel	1.8	
Holes—pole:		
Dug by hand—per hole	3.0	
Dug by machine—per hole	.5	
Dug by blasting, hand drilling—per hole	5.0	
Holes—anchor:		
Dug by hand—4 x 4 log—each	3.0	
Dug by machine—log or plank—each	.7	
Dug by machine—patent—each	.8	
Dug by hand— $\frac{5}{8}$ -inch rock—each	3.0	
Assembling hardware and placing crossarm—open wire:		
Lightweight metal—4 pins—each	.3	0.2
Round wood pole—8 pins—each	.5	.2
Setting poles (erecting, back-filling, and tamping):		
Lightweight metal—each	.4	.3
20-foot round—each	2.0	1.0
30-foot round—each	2.5	1.2
Guying:		
Placing anchor and back-filling:		
Lightweight metal poles—each	.6	
Round pole log or plank—each	3.0	
Patent—each	2.0	
Placing and tensioning guying:		
W-145, 109 GS or similar—each	1.0	.6
Wire Messenger, 2.2M—each	1.5	.8
Wire Messenger, 6M or 10M—each	2.5	1.0
Installing line wire (placing, sagging, and tying-in):		
1 pair—mile	25	13
4 pair—mile	40	18
Installing messenger wire:		
6 and 10M messenger—mile	36	30
16M messenger—mile	50	40
Placing lead covered cable on messenger:		
11 to 101 pair—mile	125	80
Above 101 pair—mile	164	116
Placing insulated wire on existing pole line—mile	12	7
Ground surface construction:		
Spiral 4—mile ¹	2.6	2.6
Wire W-143 or similar—mile ¹	2.2	2.0

¹ For surveying, staking line, testing sections, and policing add 12 man-hours per mile for spiral four and 6 man-hours per mile for wire W-143.

¹ Time indicated is maximum for any operation.

a. Estimated time required for line work operations.—Continued

	Man-hours placing	Removing
Buried construction (using cable plow LC-61): †		
Spiral 4:		
1 cable—mile.....	8.5	3
2 cables, same trench—mile.....	12.0	5
Jute covered, tape armored—mile.....	45	65
Wire W-143:		
1 pair—mile.....	8.5	3
2 pairs, same trench—mile.....	12.0	5
Constructing over-head crossing for insulated wire—each (Installing messenger and rings, pulling in wire)	5.2	-----

† Does not cover operations in jungle, Arctic, or desert areas.

b. Characteristics of round telephone poles (American Standard).

Class	1	2	3	4	5	6	7
Minimum top circum- ference (inches).	27	25	23	21	19	17	15
Transverse breaking loads (pounds).	4, 500	3, 700	3, 000	2, 400	1, 900	1, 500	1, 200

Type	Length	Approximate average weight (pounds)					
Western Cedar,	20-feet	700	600	500	400	300	225
Northern Ce- dar, Creosoted		720	600	540	350	300	230
Pine.		635	555	479	418	353	310
	25-feet	850	720	600	480	400	320
		1, 020	780	600	515	420	300
		898	808	686	602	508	423
	30-feet	1, 000	850	730	610	500	420
		1, 320	1, 170	870	630	520	420
		1, 241	1, 076	921	780	672	573
	35-feet	1, 200	1, 000	850	750	650	560
		1, 620	1, 380	1, 060	820	720	510
		1, 603	1, 410	1, 213	996	865	733

Northern and Western Cedars are furnished butt treated; pine is treated full length. An estimate of the shipping space required for poles:

$$\frac{\text{Average weight (pounds)} \times \text{constant}}{40} = \text{Measurement tons}$$

Values of the constant are:

Cedars=0.052

Pine=0.026

c. Comparison of the means to obtain telephone channels—100 miles.

	Construction time in man-days ¹	Ship tons	Measure- ment tons
Radio relay, 4-channel ²	35	10	26
Radio relay, 12-channel ²	50	53	279
Radio relay, 24-channel ²	60	53	279
CF carrier on spiral—4 (buried):			
Total 4 channels.....	285	50	75
CF carrier on spiral—4 (suspended):			
Total 4 channels.....	440	50	75
O Carrier on open wire (light weight metal poles and crossarms) 2 sys- tems:			
Total 16 channels ⁴	105	187	192
C Carrier on Standard open wire (30-foot poles spaced 150 feet)—4 sys- tems:			
Total 16 channels ⁴	10,060	6,204	9,846
O Carrier on standard open wire (30-foot poles spaced 150 feet):			
Total 32 channels ⁴	10,120	6,204	9,846

¹ Does not apply to operations in jungle, arctic, or desert.

² Repeater spacing, approximately 25 miles.

³ Includes site survey and selection, travel time, equipment and antenna installation time, etc. (Antennas are field type, not steel towers.)

⁴ Repeater spacing, approximately 100 miles.

⁵ Construction time is based on signal construction battalion day consisting of 500-man-days and completion of 5 miles of O. W. per day.

d. Commercial type telephone switchboard capacity—position comparison.

<i>Local switchboard capacity—lines</i>	<i>Positions</i>
100.....	1 or 2.
400.....	7 basic.
600.....	10 basic.
800.....	11 basic.
1,000.....	14 basic.
1,200.....	16 basic.
1,600.....	20 basic.
2,000.....	27 basic.
2,800.....	40 basic.
3,600.....	60 basic.
<i>Toll switchboard capacity—lines</i>	
100.....	15.
200.....	25.
300.....	34.
400.....	40.

e. LOCAL (Common Battery Manual)..... Call Handling Time and Traffic Distribution.

RESTRICTED—Security Information(1) *Call Handling Time:*

One operator handles 150 calls per operator hour.
 Two operators handle 200 calls per operator hour.
 Three operators handle 220 calls per operator hour.
 Four operators handle 225 calls per operator hour.
 Five or more operators handle 230 calls per operator hour.

(2) *Distribution of Traffic (Average Situation):*

	<i>Percent</i>
Local calls.....	40
Outgoing trunk calls.....	30
Incoming trunk calls.....	30
	100

f. TOLL (Common Battery Manual) Call Handling Time and Traffic Distribution.(1) *Call Handling Time:*

One operator handles 20 calls per operator hour.
 Two operators handle 25 calls per operator hour.
 Three operators handle 30 calls per operator hour.
 Four operators handle 35 calls per operator hour.
 Five operators handle 40 calls per operator hour.

(2) *Distribution of Traffic (Average Situation):*

	<i>Percent</i>
Outward.....	55
Inward.....	30
Through (Swbd).....	15
	100

g. Normal Telephone Instrument Requirements:

- (1) One per General Officer.
- (2) One per two Field Grade Officers.
- (3) One per four Company Grade Officers.
- (4) One per 50 or 100 Enlisted Men, depending on whether troop basis is on T/O & E basis or personnel are operating as part of a large headquarters staff.

h. Building Space Requirements.
C. B. Manual Telephone Switchboard (Fixed Plant).

<i>Line Capacity</i>	<i>Switchboard Positions</i>	<i>Space Requirements—square feet</i>
100-----	1	250
100-----	2	275
200-----	2	300
200-----	4	500
600-----	10	1,380
800-----	11	1,520
1,000-----	14	1,900
1,200-----	16	2,280
1,600-----	22	2,764
2,000-----	27	3,400
2,800-----	40	4,760
Fixed Communication Center:		
Small-----		950
Medium-----		1,900
Large-----		3,000
Fixed Radio Transmitter Station:		
Small-----		2,300
Medium-----		4,425
Large-----		5,500
Fixed Radio Receiver Station:		
Small-----		1,550
Medium-----		3,600
Large-----		4,450
Antenna Field: ¹		
Transmitter:		<i>Acres</i>
Small (2 to 6 antennas)-----		6 to 30.
Medium (9 antennas)-----		35 to 100.
Large (20 antennas)-----		100 to 400.
Receiver:		
Small (2 antennas)-----		6.
Medium (20 antennas)-----		100 to 300.
Large (35 antennas)-----		200 to 600.

¹ Space is based on average conditions existing, however, depending on type antennas, equipment used etc., location, and terrain, space requirements may vary.

CHAPTER 9

LOGISTICS—MANAGEMENT

Section I. GENERAL

264. General

Preceding chapters on logistics have presented detailed data applicable to all branches of logistical planning. This chapter summarizes these data in the form of general logistical planning factors that will be found useful to staff officers at division and higher levels. It should be noted that these factors apply to *average* conditions and situations. Specific situations may require widely different factors. They should be used only as a first approximation in logistical planning or as "rule of thumb" checks against the calculations of technical planners.

265. Organizational Factors—Theater Slices

a. Division Slices.

Composition of slice by assignment of troops		Percent of slice		Composition of slice by location of troops	
Assignment	Troops			Troops	Location
Basic division.....	17,000	42	50	20,000	Division area.
Corps and army Combat.....	5,500	14			
Service.....	7,500	19	25	10,000	Corps and army rear areas.
Communications zone and theatre overhead.....	10,000	25	25	10,000	Communications zone.
Total.....	40,000	100	100	40,000	All.

b. Air Wing Slices.

Composition of slice by assignment of troops		Percent of slice		Composition of slice by location of troops	
	Troops			Troops	
Air Force combat organization.....	2,500	50			Division area.
Service organization (Air Force and army service organizations with Air Force).	1,500	30	8	400	Corps and army rear areas.
Army communications zone troops*.....	1,000	20	92	4,600	Communications zone.
Total.....	5,000	100	100	5,000	All.

*Army troops required within the theater because of the presence of Air Force elements requiring army administrative support.

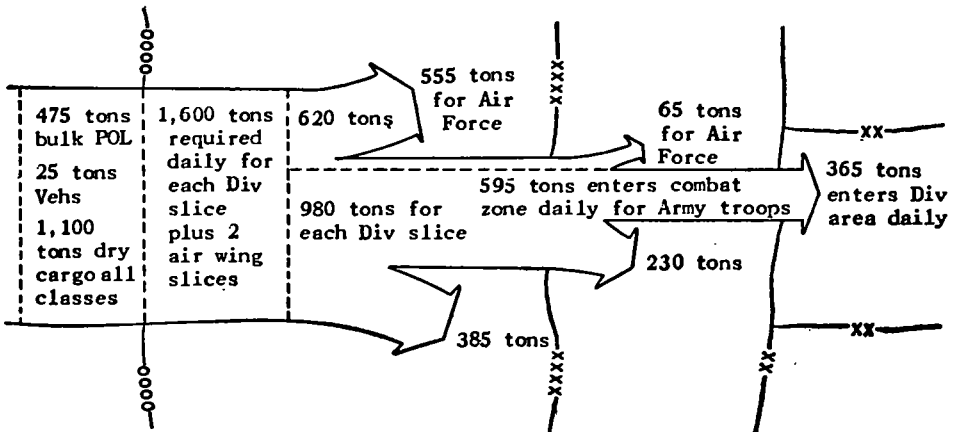
- c. Detailed figures on slices appear in paragraphs 47 through 53.
 d. During World War II, for each division slice of 40,000 men, there were two air wing slices of 5,000 men each.

Section II. LOGISTICAL FACTORS

266. Supply Factors

These factors are for use as broad initial planning factors. They do not include tonnages involved in build-up of theater reserves.

- a. Maintenance, short tons per day, for each division slice plus two air wing slices. (See par 265d.).



- b. Maintenance, pounds per man per day.

	Consumed per man in theater (Army plus Air)	Consumed by Army in theater, per Army man in theater	Consumed by Army in combat zone, per Army man in combat zone	Consumed by Army in division areas, per Army man in such areas
Bulk POL	19	10	9	5
Vehicles	1 (-)	1 (-)	1	1 (+)
Dry Cargo	44	39	31	31 (-)
TOTAL	64	50 (-)	41	37

c. Initial equipment plus 30 days' maintenance.

	Measurement tons per man in the theater (Army plus Air)	Short tons per man in the theater (Army plus Air)	Long tons per man in the theater (Army plus Air)
Initial equipment.....	4.0	1.50	1.33
30 days' maintenance dry cargo.....	¹ 1.0	.68	.60
30 days' maintenance hulk POL.....	² .4	.28	.25
Total.....	5.4	2.46	2.18

¹ In World War II, 0.8 of this figure was shipped from zone of interior and remainder procured locally.

² Bulk petroleum normally is not expressed in measurement tons. This figure is provided for the purpose of comparison with dry cargo. Bulk petroleum represents 90 percent of all petroleum shipped to the theater. The remaining 10 percent is shipped packaged and is included in dry cargo.

267. Evacuation and Hospitalization Factors

Kind of hospitalization	Quantity required
1. Mobile hospital beds (evacuation 400-750 beds, and mobile army surgical hospitals).	650 beds per division in combat.
2. Fixed petroleum beds in the theater of operations (general and station hospitals).	7 percent of theater of operations strength.

268. Transportation Factors**a. Capacities of Transportation Mediums.**

Mediums	Short tons per day	Long tons per day	Adequate to maintain
Highways (average)..... (See par. 218.)			
Gravel.....	1,000	890	2 divisions.
Medium condition.....	2,500	2,230	Corps of 4 divisions.
First class.....	8,000	7,140	Field army of 8-12 divisions.
Railways each way.....			
Single track.....	4,000	3,570	2 corps totaling 5-8 divisions.
Double track.....	12,000	10,700	Field army of 12-18 divisions.
Gasoline pipeline.....			
6-inch.....	1,470	1,310	2 corps totaling 5-8 divisions.
4-inch.....	883	788	
Discharge rate.....			
Average cargo ship.....	720	633	
Across beaches.....			
Per 1,000 yards of beach.....	1,570	1,400	
Capacities of average cargo ship.....	10,000 measurement tons or 5,000 long tons of Army cargo. ¹		
Capacities of average train in theater of operations.....	1,000 troops or 400 short tons of cargo.		

¹ See par. 240n.

b. Transportation Requirements of the Infantry Division.

Type	Requirement		
Highway.....	255 trucks of (6-truck companies) in addition to organic transport.		
Air.....	Approximately 1,744 C-119 or C-123 type aircraft and 339 C-124 type aircraft are required to airlift an infantry division. In addition to weapons and vehicles, this combination provides for the lift of 275 tons of supplies and miscellaneous equipment. These aircraft requirements are based on the substitution of light tanks for medium tanks.		
Amphibious assault.	Average strength of an <i>assault division</i> , including shore party and other attached and supporting elements, is 25,000 men with 5,000 vehicles. If 75 percent of the vehicles of the infantry division and attached and supporting elements are loaded out with the division in assault shipping, the requirements in assault shipping for reinforced division in an amphibious assault are:		
	Type	Extended voyage (10 days)	Short voyage (2-3 days)
	APA (Auxiliary transport, attack).....	15	9
	AKA (Cargo ship, attack).....	6	6
	LST (Landing ship, tank).....	12	36
	LSM (Landing ship, medium).....	12	12
	LSD (Landing ship, dock).....	3	3

269. Service Factors

a. Service Troop Factors. Service troops equal 43 percent of division slice; 60 percent of service units are in communications zone, 40 percent in combat zone.

b. Equipment Factors. One vehicle for five to six men in a balanced force.

CHAPTER 10

MISCELLANEOUS

Section I. CONVERSION FACTORS

270. Weight

	1	2	3	4	5	6
1	Unit	Long tons	Metric tons	Short tons	Kilograms	Pounds
2	1 long ton=-----		1.0160	1.1200	1,016	2,240
3	1 metric ton=-----	0.9842		1.1023	1,000	2,204.6
4	1 short ton=-----	.8929	.9072		907.2	2,000.
5	1 kilogram=-----					2.2046

271. Speed

	1	2	3	4	5	6	7	8
1	Unit	Knots	Statute miles per hour	Kilometers per hour	Feet per minute	Feet per second	Meters per minute	Meters per second
2	1 knot*=-----		1.1516	1.8532	101.34	1.6890	30.89	0.5148
3	1 mile per hr=-----	0.8684		1.6093	88.00	1.4667	26.82	.4470
4	1 km per hr=-----	.5396	.6214		54.68	.9113	16.67	.2778

*1 knot=1 nautical mile per hour.

272. Power

	1	2	3	4	5	6
1	Unit	Kilowatts	Horse power	BTU * per min	Ft lb per sec	Ft lb per min
2	1 kilowatt=-----		1.3410	56.88	737.6	44,250.
3	1 horsepower=-----	0.7457		42.42	550.0	33,000.
4	1 btu* per min=-----	.01758	.02358		12.968	778.1

*1 BTU or British thermal unit is the quantity of heat required to raise the temperature of 1 pound of water 1° Fahrenheit.

273. Angular Conversions

	1	2	3	4	5
1	Unit	Radians	Degrees	Mils	Minutes
2	1 radian=-----		57.30	1,018.6	
3	1 degree=-----	0.17453		17.778	60.
4	1 mil=-----		.05625		3.375

Note.— $360^{\circ}=2\pi$ Radians=6,400 mils.

274. Trigonometric Functions

READ DOWN					
Degrees	Sin	Cos	Tan	Cot	
0	0.0000	1.0000	0.0000	∞	90
1	.0175	.9998	.0175	57.2900	89
2	.0349	.9994	.0349	28.6363	88
3	.0523	.9986	.0524	19.0811	87
4	.0698	.9976	.0699	14.3007	86
5	.0872	.9962	.0875	11.4301	85
6	.1045	.9945	.1051	9.5144	84
7	.1219	.9925	.1228	8.1443	83
8	.1392	.9903	.1405	7.1154	82
9	.1564	.9877	.1584	6.3138	81
10	.1736	.9848	.1763	5.6713	80
11	.1908	.9816	.1944	5.1446	79
12	.2079	.9781	.2126	4.7046	78
13	.2250	.9744	.2309	4.3315	77
14	.2419	.9703	.2493	4.0108	76
15	.2588	.9659	.2679	3.7321	75
16	.2756	.9613	.2867	3.4874	74
17	.2924	.9563	.3057	3.2709	73
18	.3090	.9511	.3249	3.0777	72
19	.3256	.9455	.3443	2.9042	71
20	.3420	.9397	.3640	2.7475	70
21	.3584	.9336	.3839	2.6051	69
22	.3746	.9272	.4040	2.4751	68
23	.3907	.9205	.4245	2.3559	67
24	.4067	.9135	.4452	2.2460	66
25	.4226	.9063	.4663	2.1445	65
26	.4384	.8988	.4877	2.0503	64
27	.4540	.8910	.5095	1.9626	63
28	.4695	.8829	.5317	1.8807	62
29	.4848	.8746	.5543	1.8040	61
30	.5000	.8660	.5774	1.7321	60
31	.5150	.8572	.6009	1.6643	59
32	.5299	.8480	.6249	1.6003	58
33	.5446	.8387	.6494	1.5399	57
34	.5592	.8290	.6745	1.4826	56
35	.5736	.8192	.7002	1.4281	55
36	.5878	.8090	.7265	1.3746	54
37	.6018	.7986	.7536	1.3270	53
38	.6157	.7880	.7813	1.2799	52
39	.6293	.7771	.8098	1.2349	51
40	.6428	.7660	.8391	1.1918	50
41	.6561	.7547	.8693	1.1504	49
42	.6691	.7431	.9004	1.1106	48
43	.6820	.7314	.9325	1.0724	47
44	.6947	.7193	.9657	1.0355	46
45	.7071	.7071	1.0000	1.0000	45
	Cos	Sin	Cot	Tan	Degrees
READ UP					

275. Linear Measure

1	2	3	4	5	6	7	8	9	10	11
Unit	Nautical miles	Statute miles	Kilometers	Cable lengths	Fathoms	Meters	Yards	Feet	Inches	Centimeters
1 nautical mile=		1.1516	1.8532	8.445	1,013.4	1,853.2	2,026.8	6,080.27	72,963	185,325
1 statute mile=	0.8684		1.6093	7.333	880	1,609.3	1,760	5,280	63,360	160,933
1 kilometer=	.5396	.6214		4.557	546.8	1,000.0	1,093.6	3,281	39,370	100,000
1 cable length=	.1184	.1364	.2195		120	219.5	240	720	8,640	21,945
1 fathom=						1.829	2	6	72	182.88
1 meter=					.5468		1.0936	3.281	39.37	100
1 yard=					.5000	.9144		3	36	91.44
1 foot=					.1667	.3048	.3333		12	30.48
1 inch=								.0833		2.540
1 centimeter=								.0328	.3937	

276. Surface

	1	2	3	4	5	6	7	8	9
1	UNIT	Square miles	Square kilometers	Hectares	Acres	Square rods	Square meters	Square yards	Square feet
2	1 square mile =		2.59	259	640	102,400	2,589,945	3,097,600	.....
3	1 square kilometer =	0.3861		100	247.1	39,537	1,000,000	1,196,010	.....
4	1 hectare =		.0100		2.471	395.4	10,000	11,960	107,641
5	1 acre =			1.4047		160	4,047	4,840	43,560
6	1 square rod =						25.29	30.25	272.25
7	1 square meter =					.03954		1.1960	10.764
8	1 square yard =					.03306	.8361		9.000

RESTRICTED

277. Volume

	1	2	3	4	5	6
1	Unit	Cubic feet	Imperial gal.	U. S. gal.	Liters	Quarts
2	1 cubic foot =	X	6.229	7.481	28.32	29.92
3	1 Imperial gallon =	0.16054	X	1.2010	4.546	4.804
4	1 U. S. gallon =	.13368	.8327	X	3.785	4.000
5	1 liter =	.03532	.2201	.2642	X	1.0567
6	1 measurement ton =	40.				

Section II. PHYSICAL CONSTANTS**278. Speed of Sound**

	1	2	3	4	5	6	7	8
1	Unit	In air (at degrees F)					In water	
		10°	0°	30°	70°	100°	Fresh	Salt
2	Feet per sec =	1,039	1,050	1,083	1,127	1,171	4,700	4,752
3	Miles per hr =	708	716	738	768	797	3,205	3,246

279. Speed of Light

The speed of light is 186,324 miles per second.

280. Acceleration Due to Gravity

Acceleration due to gravity is 32.2 feet per second per second.

281. Atmospheric Pressure

Atmospheric pressure is 14.7 pounds per square inch. This is equal to the pressure exerted by a column of water 33.9 feet high, which is the theoretical maximum height to which water may be drawn by suction.

282. Circumference of the Earth at the Equator

The circumference of the earth at the equator is 24,902 miles.

283. Time Between Moons

Time between moons is 29 days, 12 hours, 44 minutes.

APPENDIX

REFERENCES

FM 5-10	Routes of Communication.
FM 5-15	Field Fortifications.
FM 5-32	Land Mine Warfare.
FM 5-35	Engineer Reference and Logistical Data.
FM 7-24	Communications in Infantry and Airborne Infantry Divisions.
FM 9-6	Ordnance Ammunition Service in the Field.
FM 11-22	Signal Communications in the Corps and Army.
FM 11-40	Signal Photography.
FM 17-70	Signal Communications in the Armored Division.
FM 21-8	Military Training Aids.
FM 21-25	Elementary Map and Aerial Photograph Reading.
FM 21-26	Advanced Map and Aerial Photograph Reading.
FM 21-30	Military Symbols.
FM 24-16	Signal Orders, Records, and Reports.
FM 24-17	Communication Center Operation.
FM 24-18	Field Radio Techniques.
FM 24-20	Field Wire Technique.
FM 24-22	Combined Visual Signaling (v/s Procedure).
FM 30-5	Combat Intelligence.
FM 30-21	Aerial Photography, Military Application.
FM 55-130	The Harbor Craft Company.
FM 57-20	Airborne Techniques for Divisional Units.
FM 57-30	Airborne Operations.
FM 100-5	Field Service Regulations, Operations.
FM 100-10	Field Service Regulations, Administration.
FM 100-11	Signal Communications Doctrine.
FM 101-1	Staff Officer's Field Manual, G-1 Manual.
FM 101-5	Staff Officer's Field Manual, Staff Organization and Procedure.
FM 105-5	Maneuver Control.
TM 5-231	Mapping Functions of the Corps of Engineers.
TM 5-240	Aerial Phototypography.
TM 5-245	Map Reproduction in the Field.
TM 5-246	Interpretation of Aerial Photographs.
TM 5-248	Foreign Maps.
TM 5-277	Panel Bridge, Bailey Type, M2.
TM 5-280	Construction in the Theater of Operations.
TM 5-283	Utilities.

RESTRICTED—Security Information

TM 5-285	Semipermanent Highway Steel Bridges, 30-, 60-, 90-Foot Spans.
TM 5-350	Military Pipe Line Systems.
TM 5-372	Unit Construction, Railway Bridge.
TM 9-2800	Military Vehicles.
TM 10-1619	Quartermaster Materials Handling Equipment.
AR 55-112	Accommodations Authorized on Commercial Rail and Water Carriers.
TM 57-210	Air Transport of Troops and Equipment.
TC-34, 1952	Land Mine Warfare.
AR 55-130	Transportation of Troops and Other Groups, General.
AR 55-135	Transportation of Troops; Railway Equipment.
AR 55-145	Transportation of Troops; Entraining, Duties En Route, and Detraining.
AR 300-15	Mapping and Charting.
AR 785-10	Acquisition, Expansion, Utilization, and Allocation of Supply and Storage Space.
SR 10-5-1	Organization and Functions, Department of the Army.
SR 110-1-1	Index of Army Motion Pictures, Kinescope Recordings and Film Strips.
SR 310-20-3	Index of Army Training Publications.
SR 310-20-4	Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
SR 310-20-5	Index of Administrative Publications.
SR 310-20-6	Index of Blank Forms.
SR 320-5-1	Dictionary of United States Army Terms.
SR 320-50-1	Authorized Abbreviations.
AFM 400-5	USAF Logistical and Operational Planning Manual.

Army Medical Bulletin No. 24, "War Casualties."
Chemical Corps Book of Standards.
Department of the Army Supply Manual.
Department of the Navy, Pontoon Gear Manual.
JANAP series.
Report of Activities, Army Ground Forces, WW II, 10 January 1946.
Supply Bulletin 38-26, Ground Ammunition Day of Supply.
TC 9, 1952.
TB 5-260-1 Office and Field Procedures for Classifying Vehicles and Bridges.

INDEX

	<i>Paragraph</i>	<i>Page</i>
Accumulation factors, hospitalization of casualties.....	167, 169	334, 338
Aerial delivery.....	56	136
Aerial supply:		
Airborne division.....	144	302
Armored division.....	144	302
Infantry division.....	144	302
Airborne division:		
Aerial supply.....	144	302
Aircraft requirements.....	56	136
Ammunition supply data.....	110	252
Class III data.....	96	219
Organization.....	7	10
Supply requirements.....	130	296
Vehicles and equipment.....	9	10
Weapons.....	8	10
Airborne field army.....	56	136
Airborne operations:		
Troop requirements for.....	50	99
Aircraft:		
Airfield construction.....	261	466
Cargo aircraft.....	239	399
Cargo weight factors.....	239	399
Characteristics.....	239	399
Helicopters.....	222-224	373
Aircraft requirements.....	56, 238	136, 397
Infantry division.....	56	136
Airfields:		
Capabilities.....	236	397
Construction.....	261	466
Air Force:		
Photographic units.....	39	60
Air movement.....	56	136
Air terminals.....	234	396
Air transport.....	235-239	396
Infantry division.....	183	344
Ambulance requirements.....	172	340
Ammunition.....	103-119	231
Basic data.....	104-105	234
Chemical.....	63, 106	161, 243
Combat vehicle.....	107	245
Expenditures.....	108-109	248
Supply.....	103	231

RESTRICTED—Security Information

	Paragraph	Page
Amphibious operations.....	57	148
Assault:		
Division shipping.....	183	344
Shipping.....	268	478
Base development.....	232	388
Beaches, unloading.....	232	388
Characteristics, ships and craft.....	232	388
Ship-to-shore supply.....	232	388
Troop requirements.....	51	101
Vehicles.....	87	203
Amphibious support brigade:		
Organization.....	16	11
Vehicles and equipment.....	18	13
Weapons.....	17	12
Anchorage areas.....	231	379
Animals:		
Evacuation and hospitalization.....	173-179	340
Pack animals.....	227	377
Armored cavalry:		
Ammunition supply data.....	113	266
Class III data.....	99	226
Field army.....	48	80
Armored division:		
Aerial supply.....	144	302
Ammunition supply data.....	111	255
Class III data.....	97	221
Organization.....	10	10
Rail movement.....	204	359
Road space and time lengths.....	55	113
Supply requirements.....	131-134	296
Time factors.....	55	113
Trains.....	220	372
Vehicles and equipment.....	12	10
Weapons.....	11	10
Army:		
Field army supply requirements.....	129	295
Organic army troops.....	2	4
Type field army.....	47, 48	80
Army areas:		
Map of.....	2	4
Army maintenance area.....	253	432
Artillery:		
Ammunition expenditures.....	109	251
Ammunition supply data.....	114	269
Class III data.....	100	227
Field army.....	48	80
Available supply rate.....	103	231
Balanced loading.....	244	416
Barbed wire.....	76	191
Barges:		
Requirements.....	188	349

RESTRICTED—Security Information

	Paragraph	Page
Basic loads.....	103-119	231
Airborne division.....	110	252
Armored cavalry.....	113	266
Armored division.....	111	255
Artillery units.....	114	269
Chemical units.....	115	276
Engineer units.....	116	277
Infantry division.....	111	255
Signal units.....	117	277
Battalion month.....	254	432
Beaches:		
Capacities.....	232, 268	388, 478
Unloading over.....	232	388
Bed requirements.....	166-169	333
Determination of.....	168	337
Dispersion factor.....	167	334
Zone of interior.....	169	338
Billeting.....	259	447
Bivouac areas.....	259	447
Boats.....	90	209
Assault.....	74	182
Fuel.....	92	210
Requirements, inland waterways.....	188	349
Bridges:		
Construction.....	255	434
Marking of.....	73	180
River crossing equipment.....	74	182
Buildings:		
Construction.....	259	447
Cableways.....	226	376
Capacity:		
Beaches, unloading.....	232	388
Cargo ships.....	247	417
Highways, by type.....	218	371
Ice, load bearing.....	79	195
Inland waterways.....	187	348
Lines of communication.....	182	344
Pipe lines.....	184	347
Railways, foreign.....	206	360
Vehicles, highway operation.....	217	371
Cargo:		
Discharge rates.....	231	379
Handling equipment.....	231	379
Cargo ships.....	246-247	417
Discharge rates.....	268	478
Casualties:		
Admission rates.....	162-164, 165	329, 333
Airborne.....	21	18
Amphibious operations.....	21	18

RESTRICTED—Security Information

Casualties—Continued	<i>Paragraph</i>	<i>Page</i>
Animals.....	174	340
Classification of.....	161,	329,
	163, 164	330,
		331
Daily loss rates.....	23	29
Distribution of.....	23	29
Estimates.....	164	331
Returns to duty.....	23	29
Theatre estimates.....	23	29
Characteristics:		
Aircraft.....	239	399
Chemical:		
Ammunition.....	106	243
Weapons, agents, munitions.....	63	161
Chemical equipment.....	84	199
Chemical units:		
Ammunition, supply data.....	115	276
Class III data.....	901	229
Field army.....	48	80
Class I:		
Requirements.....	125-143	291
Storage area.....	147	312
Supply.....	82, 83	198,
		199
Class II and IV:		
Requirements.....	125-143	291
Storage area.....	147	312
Supply.....	84-91	199
Class III:	92-102	210
Construction of facilities.....	260	461
Requirements.....	125-143	291
Storage area.....	147	312
Class V.....	103-119	231
Combat vehicles.....	107	245
Requirements.....	125-143	291
Storage area.....	147	312
Climate:		
Housing for.....	259	447
Close column.....	55	113
Combat loading.....	242	415
Combat zone:		
Class V supply.....	103	231
Road net.....	255	434
Supply installations.....	160	326
Supply requirements.....	128	294
Command posts:		
Signal communications.....	67	176
Commercial loading methods.....	243	415
Commodity loading.....	244	416
Communications systems:		
Users served.....	65	174

RESTRICTED—Security Information

	<i>Paragraph</i>	<i>Page</i>
Communications zone:		
Road net.....	255	434
Supply requirements.....	128	294
Troop requirements.....	49	97
Construction.....	254-264	432
Fortifications.....	76	191
Signal.....	263	471
Conversion factors.....	270-277	480
Convoy loading.....	242	415
Corps:		
Organic corps troops.....	4	6
Craft:		
Amphibious, characteristics.....	232	388
Day of supply.....	103, 123	231, 283
Decorations.....	29	42
Defense:		
Fortifications.....	76	191
Demolitions:		
Basic data.....	105	241
Harbors.....	257	441
Sets.....	75	191
Density:		
Trains in theater of operation.....	191	351
Department of the Army:		
Organization.....	1	3
Depots:		
Combat zone.....	160	326
Construction.....	259	447
Distances:		
Sailing from POE.....	248	424
Distribution.....	157-160	321
Bulk petroleum.....	260	461
Maps.....	41	68
POL.....	93	213
Division:		
Slice.....	52,	103,
	53,	105,
	265	476
Trains.....	219-221	372
Dredging.....	258	446
Engineers:		
Aviation engineers.....	261	466
Construction.....	254-263	432
Equipment.....	85, 91	200, 210
Field army.....	48	80
Fortification material.....	91	210
Mapping units.....	39	60
Water supply and equipment.....	119	278

RESTRICTED—Security Information

	Paragraph	Page
Engineer units:		
Ammunition supply data.....	116	277
Equipment:		
Airborne division.....	9	10
Amphibious support brigade.....	18	13
Armored division.....	12	10
Cargo handling, ports.....	231	379
Chemical.....	84	199
Engineer.....	85, 91	200, 210
Infantry division.....	15	10
Materials handling:		
Characteristics.....	156	319
Requirements for.....	154	316
Medical.....	86	201
Ordnance.....	86	201
Quartermaster.....	88	207
Railways, estimates of.....	194	352
Signal.....	89	208
Transportation.....	90	209
Estimates:		
Casualties.....	164	331
Class III.....	95	215
Class V expenditures.....	108-109	248
Combat zone personnel.....	21	18
Inland waterway capacities.....	187	348
Port capacity.....	231	379
Prisoners of war.....	24-26	40
Railway equipment.....	194	352
Supply level build-up.....	158	321
Theater personnel losses.....	23	29
European theater:		
Supply requirements.....	125	291
Evacuation of casualties:		
Animals.....	178	342
Capacity of transportation.....	170	339
Time required.....	171	340
Evacuation policy.....	167	334
Field fortifications.....	76	191
Flares:		
Basic data.....	105	241
Forced march.....	54	107
Fords:		
Depth of water.....	78	195
Formula:		
Bed requirements.....	168	337
Capacity, inland waterways.....	187	348
Density, water column.....	55	113
Determining railway equipment.....	194	352
Level of supply build-up.....	158	321
Lines of communications capacity.....	182	344
Road space.....	55	113

RESTRICTED—Security Information

	Paragraph	Page
Formula—Continued		
Time length.....	55	113
Traffic flow.....	55	113
Truck company requirements.....	215	369
Fortifications:		
Materials.....	91	210
Fuel and lubricants.....	92-102	210
Gage:		
Railway.....	183, 189	344,
Gasoline (<i>see</i> Class III POL)		350
Grenades:		
Basic data.....	105	241
Chemical.....	106	243
Harbors:		
Dredging.....	258	446
Headquarters:		
Army.....	34	47
Corps.....	33	45
Division.....	32	44
Internal arrangement.....	31-34	43
Helicopters.....	222-224	373
Characteristics.....	223	374
Factors in use of.....	224	375
Highway:		
Bridge construction.....	255	434
Bridges.....	74	182
Capacities of.....	268	478
Capacity by type.....	218	371
Construction.....	255	434
Lines of communication hauls.....	215	369
Local hauls.....	215	369
Highway transport:		
Planning factors.....	214	368
Hospitalization:		
Admission rate.....	162-164	329
Animals.....	176-177	341
Bed requirements.....	166-169	333
Requirements.....	267	478
Hospitals:		
Construction.....	259	447
Housing:		
Administrative.....	259	447
Troops.....	259	447
Hydrographic features.....	57	148
Ice:		
Load bearing capacity.....	79	195
Infantry division:		
Aerial supply.....	144	302
Air movement.....	56	136
Air transport.....	183	344

RESTRICTED—Security Information

	Paragraph	Page
Infantry division—Continued		
Ammunition supply data.....	112	263
Basic loads.....	112	263
Class III data.....	98	224
Organization.....	13	10
Rail movement.....	204	359
Requirements, assault shipping.....	268	478
Road space and time lengths.....	55	113
Service installations.....	252	431
Supply requirements.....	135-143	298
Time factors, water move.....	55	113
Transportation requirements.....	268	478
Vehicles and equipment.....	15	10
Weapons.....	14	10
Infantry division trains.....	221	373
Inland waterways:		
Capacities.....	187	348
Characteristics.....	186	347
Types.....	186	347
Installations:		
Army maintenance area.....	253	432
Division service.....	252	431
Supply, combat zone.....	160	326
Kitchens:		
Preparation of food.....	83	199
Labor:		
Construction.....	254-261	432
Fortifications.....	76	191
Handling supplies.....	153	315
Landing craft.....	232	388
Lead times, procurements.....	145	307
Lighterage:		
Discharge rates.....	231	379
Wharf requirements.....	231	379
Lines of communications:		
Calculating capacities.....	182	344
Factors concerning.....	182	349
Loading:		
Railway cars.....	203,	359,
	208,	362,
	212	367
Rail movement.....	207	361
Locomotives:		
Fuel.....	92	210
Logistical commands:		
Organization.....	6	7
Losses and replacements:		
Categories of losses.....	20	16
Combat zone.....	21	18
Communications zone.....	22	29
Gross losses.....	20	16
Loss experience.....	20	16

RESTRICTED—Security Information

	Paragraph	Page
Mail.....	30	43
Maintenance:		
Daily maintenance requirements.....	266	477
Flow of supplies.....	124	283
Initial, 30 days.....	81	196
Roads and highways.....	255	434
Maintenance area, army.....	253	432
Mapping units:		
Capabilities.....	39	60
Maps:		
Allowances.....	38	54
Classification.....	37	52
Depots.....	40	67
Distribution.....	41	68
Estimates for.....	38	54
Production of.....	39	60
Requirements.....	38	54
Responsibility.....	36	50
Scale.....	37	52
Type.....	39	60
Weights and size.....	40	67
Marches.....	54	107
March graph:		
Water move.....	55	113
March table:		
Water march.....	55	113
Medical:		
Equipment.....	86	201
Medical units:		
Field army.....	48	80
Messages:		
Speed of transmission.....	71	179
Transmission by.....	66	175
Messengers:		
Rate of travel.....	68	177
Military police:		
Field army.....	48	80
Mines:		
Basic data.....	105	241
Chemical.....	106	243
Mine fields.....	77	194
Movement:		
Air.....	56	136
Air, helicopter.....	222-224	373
Air, supplies.....	238	397
Amphibious operations.....	57	148
By railway.....	200-212	357
Density.....	55	113
Motor moves.....	55	113
Motor, by echelon.....	55	113
On foot.....	54	107
Traffic flow, motor columns.....	55	113

RESTRICTED—Security Information

	Paragraph	Page
Native bearers.....	229	377
Natural phenomena.....	44-46	74
Open column.....	55	113
Ordnance:		
Ammunition data.....	104, 105	234, 241
Equipment.....	87	203
Ordnance units:		
Field army.....	48	80
Organization:		
Airborne division.....	7	10
Amphibious support brigade.....	16	11
Armored division.....	10	10
Army areas.....	2	4
Department of the Army.....	1	3
Infantry division.....	13	10
Logistical commands.....	6	7
Organic army troops.....	3	6
Organic corps troops.....	4	6
Pacific theater:		
Supply requirements.....	126	292
Personnel:		
Division slice.....	52, 53	103, 105
General.....	19	16
Losses and replacements.....	20-23	16
Port operation.....	231	379
Railway operation.....	196-198	356
Storage operations.....	151-153	314
Wing slice.....	52-53	103
Personnel Estimates:		
Airborne operations.....	21	18
Physical constants.....	278-283	484
Pipelines:		
Capabilities.....	185	347
Capacities of.....	268	478
Capacity.....	184	347
Construction.....	260	461
Operation.....	260	461
Planning data:		
Vessel characteristics.....	246, 247	417
POL:		
Conversion factors (see also Class III, Fuel).....	94	214
Polar Regions:		
Supply requirements.....	127	293
Ports:		
Air terminals.....	234	396
Capacity estimation.....	231	379
Construction.....	257	441
Dredging.....	258	446

RESTRICTED—Security Information

	Paragraph	Page
Ports—Continued		
Facilities.....	231	379
Rehabilitation.....	257	441
Use of beaches.....	232	388
Prisoners of War:		
Estimates.....	24-26	40
Prisoner of War camps:		
Construction.....	259	447
Procurement lead times.....	145	307
Psychological warfare:		
Supplies.....	122	282
Quartermaster:		
Equipment.....	88	207
Quartermaster units:		
Field army.....	48	80
Radio traffic.....	70	179
Rafts.....	74	182
Railways:		
Bridges.....	74	182
Capacities of.....	268	478
Construction.....	256	438
Foreign.....	206	360
Gages.....	189	350
Rehabilitation.....	256	438
Rolling stock.....	195	355
Train density.....	191	351
Types and capacity.....	183	344
Ranges, firing.....	59	154
Rations:		
Characteristics (see also Class I).....	82	198
Handling, preparing (see also Class I).....	83	199
References.....	App	485
Rehabilitation:		
Ports.....	257	441
Railways.....	256	438
Requirements:		
Aircraft.....	56	136
Aircraft, supplies.....	238	397
Ambulances.....	172	340
Chemical ammunition.....	63	161
Class III.....	95-102	215
Communications zone troops.....	49	97
Craft, inland waterways.....	188	349
Hospital beds.....	166-169	333
Maps.....	38-42	54
Materials handling equipment.....	154	316
Personnel, railway operation.....	196-198	356
Supply.....	123-144	283
Supply levels.....	158	321
Terrain models.....	43	72

RESTRICTED—Security Information

Requirements—Continued	Paragraph	Page
Troops:		
Airborne operations.....	50	99
Amphibious operations.....	51	101
Field army.....	48	80
Troop movement by railway.....	200, 202, 204, 206	357, 358, 359, 360
Truck companies.....	215	369
Requisition and shipping times.....	157	321
River crossing equipment.....	74	182
Roads.....	255	434
Road nets.....	255	434
Road spaces.....	54	107
Motor column.....	55	113
Rolling stock:		
Characteristics.....	195	355
Foreign railways.....	206	360
Sailing distances.....	248	424
Selective loading.....	244	416
Ships:		
Amphibious, characteristics.....	232	388
Shipping:		
Discharge rates.....	231	379
Methods of loading.....	242-244	415
Nomenclature, merchant ships.....	245	416
Planning factors.....	183	344
Requirements, assault division.....	183	344
Turn-around times.....	249	426
Vessel characteristics.....	246, 247	417
Wharfs for.....	231	379
Shops:		
Construction.....	259	447
Signal:		
Equipment.....	89	208
Fortification material.....	91	210
Signal communications.....	64-71	174
Construction.....	263	471
Means of transmission.....	66	175
Radio.....	70	179
Speed of transmission.....	71	179
Wire.....	69	177
Signal construction.....	69	177
Signal units:		
Ammunition supply data.....	117	277
Field army.....	48	80
Site area.....	146-150	307
Sleds:		
Sled trains.....	228	377

RESTRICTED—Security Information

	Paragraph	Page
Slice:		
Division.....	52, 53	103, 105
Theater.....	265	476
Wing.....	52, 53	103, 105
Smoke:		
Chemical.....	106	243
Solid fuels.....	95	215
Special loading.....	244	416
Storage.....	146-156	307
Bulk petroleum.....	260	461
Construction.....	259	447
Definition of terms.....	146	307
Maps.....	40	67
Personnel.....	151, 153	314, 315
Storage area.....	146	307
Storage area requirements.....	147	312
Storage space:		
Covered storage.....	148-150	313
Open storage.....	148-150	313
Supplies:		
Adjutant general.....	120	282
Air movement.....	238	397
Amphibious operations.....	183	344
Army exchange.....	121	282
Supply:		
Build-up.....	158, 159	321, 323
Class I.....	82, 83	198, 199
Class II and IV.....	84-91	199
Class III.....	92-102	210
Class V.....	103-119	231
Daily maintenance requirements.....	266	477
General factors.....	81	196
Installations.....	160	326
Levels.....	158	321
Paper.....	122	282
Points.....	160	326
Requirements.....	123-144	283
Time elements, Class I.....	83	199
Water.....	119	278
Tanks, storage.....	260	461
Task force.....	5	7
Tentage.....	259	447
Tent camps.....	259	447
Terminals:		
Inland terminals.....	233	394
Terrain models:		
Requirements for.....	43	72

RESTRICTED

499

THE ARMY LIBRARY

WASHINGTON, D. C.

RESTRICTED—Security Information

	Paragraph	Page
Theater slice.....	265	476
Tides.....	46	76
Time:		
Conversion.....	44	74
Suffixes.....	44	74
Zones.....	44	74
Time factors:		
Motor move, division.....	55	113
Time Intervals:		
Requisition and shipping times.....	157	321
Time length:		
Motor column.....	55	113
Traffic flow:		
Motor columns.....	55	113
Training.....	58-61	153
Training facilities.....	58, 59	153, 154
Transways.....	226	376
Transportation:		
Aircraft.....	235-239	396
Cableways and transways.....	226	376
Capacities of medium of.....	268	478
Casualties.....	170	339
Equipment.....	90	209
Helicopters.....	222-224	373
Highway.....	213-221	368
Human bearers.....	229	377
Pack animals.....	227	377
Planning.....	181	343
Planning factors.....	183	344
Requirements, infantry division.....	268	478
Sled trains.....	228	377
Transportation units:		
Field army.....	48	80
Trigonometric functions.....	274	481
Trucks:		
Amphibious.....	232	388
Capacities.....	55	113
Planning factors.....	214	368
Truck companies:		
Capabilities.....	215	369
Twilight:		
Periods of.....	46	76
Umpires.....	60, 61	155
Unit equivalents, construction.....	254	432
Unit loading.....	242	415
Vehicles.....	87-90	203
Airborne division.....	9	10
Amphibious support brigade.....	18	13
Armored division.....	12	10

RESTRICTED—Security Information

	<i>Paragraph</i>	<i>Page</i>
Vehicles—Continued		
Capacity, highway operation.....	217	371
Fuel and lubricants.....	92	210
Infantry division.....	15	10
Loading capacity of cargo ships.....	247	417
Losses in combat.....	262	470
Veterinary units.....	179	342
Water:		
Supply and requirements.....	119	278
Weapons:		
Airborne division.....	8	10
Armored division.....	11	10
Characteristics.....	62	156
Chemical.....	63	161
Infantry division.....	14	10
Towed weapons.....	87	203
Wharves:		
Construction.....	257	441
Requirements for.....	231	379
Wing slice.....	52-53,	103,
	265	105,
		476
Wire:		
Barbed wire.....	76	191

RESTRICTED—Security Information

[AG 400 (15 Jun 53)]

BY ORDER OF THE SECRETARY OF THE ARMY:

OFFICIAL:

WM. E. BERGIN
Major General, USA
The Adjutant General

J. LAWTON COLLINS
Chief of Staff, United States Army

DISTRIBUTION:

Active Army:

GSUSA (25); Tech Svc (1); Tech Svc Bd (2); AFF (40); OS
Maj Comd (5); Base Comd (2); MDW (15); A (ConUS)
(30); CHQ (10); Div (10); Brig (3); Regt (5); Sep Bn (2);
FT (2); USMA (10); Sch (5) except 3, 6, 17 (10), 5, 7, 9,
10, 11 (25); PMS & T (1); Dep (3); Tng Div (10); GH
(2); POE (5); PRGR (2); Ars (2).

NG: Same as Active Army except one copy to each unit.

Army Reserve: Same as Active Army except one copy to each unit.

For explanation of distribution formula, see SR 310-90-1.

3000031604

U
408.3
.A1
FM101-10
1953

203051

**ARMY LIBRARY
WASHINGTON, D. C.**

RESTRICTED—Security Information



WARNING NOTICES

Authority for release of this document to a foreign government must be secured from the Assistant Chief of Staff, G-2, Department of the Army.

When this document is released to a foreign government, it is released subject to the following conditions: This information is furnished with the understanding that it will not be released to another nation without specific approval of the United States of America, Department of the Army; that it will not be used for other than military purposes; that individual or corporation rights originating in the information whether patented or not will be respected; and that the information will be afforded substantially the same degree of security as afforded by the United States of America, Department of the Army.

This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws, Title 18 U. S. C., sections 793 and 794. The transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

RESTRICTED